DEVELOPMENTAL DIAGNOSIS

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Normal and Abnormal Child Development

CLINICAL METHODS
AND PEDIATRIC APPLICATIONS

by

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SECOND EDITION: REVISED AND ENLARGED

PAUL B. HOEBER · INC

Medical Book Department of Harper & Brothers

NEW YORK   LONDON

DEVELOPMENTAL DIAGNOSIS

SECOND EDITION, 1947

PREFACE TO THE SECOND EDITION

The first edition of the present volume appeared six years ago. Three printings during this interval and translations into foreign languages have evidenced a growing interest in the clinical aspects of child development. The publishers have granted us a welcome opportunity to add new materials gained chiefly through continuing clinical investigations of new and old cases seen on the diagnostic and advisory services of the Yale Clinic of Child Development.

As a result of further clinical experience we are able to present with discussion a sizeable number of additional case studies illustrating the diagnostic problems involved in amentia, convulsive disorders, cerebral injuries, blindness, deafness, infantile aphasias, congenital anomalies, and prematurity. Consideration is also given to new data concerning the developmental implications of prenatal rubella, the Rh factor, retrolental fibroplasia, and electroencephalographic findings. A total of some seventy illustrative case sketches are now presented in close association with explanatory text.

The behavior growth and behavior hygiene of the fetal-infant are discussed in a new section based on our recent volume entitled, *The Embryology of Behavior.* Another new section deals with the physician's role in the increasingly important problem of child adoption.

The Appendices and Bibliography have been brought up to date and call attention to recent literature on the practical phases of developmental guidance. Appendix F projects a type of medical education necessary for professional specialization in the field of developmental diagnosis and supervision.

The concluding chapter on Developmental Pediatrics also is new. It outlines both present and future possibilities in the domain of developmental diagnosis. By *developmental pediatrics* we mean

a form of clinical medicine which is systematically concerned with the diagnosis and supervision of child development. This phase of pediatrics has vast implications for the social aspects of medicine.

Indeed, all pediatric medicine has assumed a new importance in the period of postwar reconstruction upon which we are now entering. Instinctively it is felt that this reconstruction demands an intensified conservation of the development of infants and young children. How can we gain command of our civilization if life and growth are not cherished at their source?

Responsive to deep social forces the American Academy of Pediatrics has organized a remarkable nationwide study of the child health services of the United States, and is currently conducting a survey of the character and scope of pediatric education in medical schools and teaching hospitals. This is a basic approach to fundamental human problems which need a medical technology rivaling atomic science in thoroughness and purposefulness.

The Clinic of Child Development   A. G.
School of Medicine, Yale University

PREFACE TO THE FIRST EDITION

This book is the fruit of a clinical loom. For a period of years the authors have been jointly engaged with the practical problems of diagnosis and advisory guidance which have arisen in an outpatient clinic for infants and preschool children. Through fortunate circumstances this clinical service has always been conducted in close correlation with a systematic study of normal child development. One interest has reinforced the other. Observations of normal behavior threw light on maldevelopment; and the deviations of development in turn helped to expose what lay beneath a deceptive layer of "obviousness" in normal infancy. We have come to sense the identity of the developmental processes which in equal measure determine the reaction patterns of the intact and the defective child, the well endowed, the partially endowed, and those blemished by injury and disease.

It is these deep, determining developmental processes which must inevitably come within the scope of clinical medicine. In preparing this volume we have had much in mind the medical student who in private or public capacity will soon be confronted with varied and exacting problems which concern the developmental welfare both of normal and abnormal children.

Medical education has sometimes been criticized for neglecting the normal characteristics of man at the expense of the pathological. If we acknowledge that development as well as disease falls within the province of medicine and public health, the criticism has some force. The strong trend toward preventive and supervisory medicine obliges us to understand assets as well as liabilities, favorable as well as unfavorable symptoms. The pediatrician and the general practitioner have to deal increasingly with relatively well children. All this places a premium upon a broad type of developmental supervision, directed toward the realization of normal potentialities.

In the present volume we have given equal weight to the normal, the atypical and the abnormal expressions of early child development. The outline of normal development is abundantly illustrated with photo-tracings based on cinema records. We hope that the concreteness of this outline will give clinical status to normality, and will serve as a background for interpreting both typical and atypical manifestations of growth.

The chapters on developmental defects and deviations are especially directed to the practitioner who faces a host of problems in every complex case of developmental failure which comes to his attention. We have considered not only the technical but the commonplace and human aspects of these problems.

The concluding chapters suggest practical avenues of application both present and impending. New social forces are slowly altering the techniques of medicine. There is a mounting demand for periodic health examinations and for consecutive individualized supervision. The state of the world is troubled, but society in the very impulse of self-preservation will demand increased protection for the sources of life. We can conserve those sources only through a more thorough-going supervision of early child development.

Diagnosis remains the fundamental task of medicine; because in last analysis intelligent treatment, guidance, and supervision must rest upon accurate diagnostic appraisal. This is peculiarly true of developmental conditions. The present volume is primarily devoted to methods of diagnosis and to the applications which rest securely on diagnosis. These methods are outlined in such a manner that the clinician can take them over by partial stages and can suit them to his needs and to increasing clinical experience. They are safe in the hands of a clinically minded user. We have attempted to simplify and to adapt the results of long research to the practical requirements of office, hospital, and institution.

The research has involved many studies which have been reported in previous publications and which amply reflect our indebtedness to co-workers. The primary investigations were supported by The Rockefeller Foundation and by Yale University.

The present volume is made possible by the timely support of The Carnegie Corporation of New York.

The Clinic of Child Development   A. G.
School of Medicine, Yale University

INTRODUCTION

This book is an outgrowth of years of clinical experience in the developmental examination of infants and preschool children. The procedures outlined are based on an extensive investigation of normal mental growth during the first five years of life. The results of this investigation have been reported in several previous publications, including *The First Five Years of Life*; also *An Atlas of Infant Behavior: A Systematic Delineation of the Forms and Early Growth of Human Behavior Patterns*.

The reader must be referred to these publications for details concerning the underlying researches which have been in progress over a period of twenty years. A large number of normal children were examined at lunar month intervals in the first year, and at less frequent intervals later, embracing twenty-five consecutive age levels up to the fifth year. A still greater number of infants and children who presented developmental deviations and defects were studied in an active Infant Outpatient Service, and in connection with the diagnostic, advisory and therapeutic work of a Guidance Nursery for children from 18 months to 4 years of age. The protocols and case-records included detailed accounts of behavior, under normative, naturalistic and clinical conditions. Cinema records were analyzed to chart and to define the behavior characteristics.

This survey of the genesis and growth of patterns of behavior has supplied us with concrete norms of maturity. These norms have been put to extensive practical test under medical auspices. They have proved effective not only in the study of normal variations of development, but in the diagnosis and supervision of pediatric, neurological and psychiatric conditions. The present volume describes the norms and procedures in condensed and simplified form in order to make them available to students and practitioners of medicine.

In recent years there has been an increasing tendency to look upon problems of health and disease from a developmental point of view. Development has ceased to be a vague abstraction, and is instead regarded as an organic process which yields to scientific analysis and to diagnostic appraisal. Experimental embryology, biochemistry, and endocrinology have supplied new insights into the physiology of growth. A scientific journal entitled *Growth* was recently founded for "the coordination of studies of increase and development as general properties of nature," the term "growth" being freely interchangeable with "development." Another journal bearing the name *Psycho-somatic Medicine* reflects the new trend which brings the physical and the functional aspects of growth into closer correlation. From a biological standpoint no sharp distinction can be made between bodily and mental manifestations of development. Developmental status, accordingly, must be appraised not only by physical signs but also by dynamic signs, by modes of reaction, by patterns of behavior. Behavior is in fact the most integrated and inclusive expression of developmental status.

The medical committees of the last two White House Conferences on Child Welfare (1930 and 1940) have emphasized the importance of protecting mental as well as physical growth. The National Research Council has fostered the study of child development as a branch of human biology. The American Academy of Pediatrics has included a knowledge of physical and mental growth among its specialty certification requirements. The recent report of the Committee on Graduate Medical Education states: "The intern should be given work in pediatrics which in essence is general medicine for the child. . . . A basic element of pediatrics is growth and development which is the chief factor differentiating this field from medicine for adults."

Medical schools reflecting this trend are giving increasing attention to the study of the normal organism. Pediatrics in particular is concerned with normal development as well as disease, with prevention as well as cure, and with periodic supervision as well as emergency diagnosis.

Social forces, as suggested in the preface, are placing a premium upon a periodic appraisal of the developmental assets and liabilities of the growing child. Personalized infant welfare supervision by the

private practitioner, by public health nurses, well baby conferences, nursery schools, preschool play groups, school entrance examinations, parent education, child guidance clinics, and a tidal wave of baby books and child health literature, have created a concrete demand for a broadened type of protection of the child's growth. Full protection can be attained only through the application of medical science—diagnostic, therapeutic, and supervisory.

With the heavy demands already made upon the medical practitioner, it is not assumed that he should take over an undue load of psychological and psychiatric technique. The present volume is in no sense a handbook for intelligence testing or I.Q. "measurements." It presents the behavior aspects of developmental maturity from an objective standpoint, comparable to that of clinical neurology. It is the maturity and organization of the neuro-motor system with which we are chiefly concerned. We are, in fact, dealing with developmental neurology.

PLAN OF THE VOLUME

For the preliminary orientation of the reader a brief statement of the organization of the volume may prove helpful.

The text cleaves consistently to the central problem of diagnosis. There is no elaboration of theory for its own academic sake. Part One outlines basic principles and methods and affords a panoramic view of early child development. The nature of behavior and of mental growth is discussed in the first chapter.

Our longest chapter (Chapter III) is the most basic in the book, because it integrates the developmental tests, the behavior characteristics, and the growth trends of the behavior patterns for the period from 4 weeks to 3 years. This chapter is organized for convenient reference and is illustrated with over a hundred photo-tracings of normative behavior patterns.*

Part Two is concerned with defects and deviations of development which are interpreted in terms of normal criteria. Basic attention is given to the problem of amentia because of its prime importance in differential diagnosis. Significant differences in etiology and symp-

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* We are greatly indebted to Ralph D. Alley for his skillful rendering of these drawings. They were made directly from photographic projections of cinema recordings and had the benefit of Mr. Alley's special interest as a student of medicine at Yale.

tomatology determined separate chapters for endocrine, convulsive, and traumatic conditions, sensory and environmental deprivations and prematurity of birth. Consideration is given to the effect of these conditions on performance, on trends of development, and on personality organization. Illustrative case sketches are included in all of these chapters, but the emphasis is varied to do justice to the underlying mechanisms of development and to the special problems of diagnosis.

We give special attention to the neurological aspects of developmental diagnosis in Chapters XI and XII. They afford an introduction to that vast territory of infant neurology which is not reached by ordinary clinical methods.

Part Three deals with methods of protecting early child development, through private medical practice and public health measures.

The Appendix is virtually a condensed manual of directions for the various developmental test procedures and for the setting up of examination arrangements. The comprehensive growth trend chart which covers a score of age intervals in great detail is intended as a detailed guide for the interpretation of cases which require special study.

The fourth section of the appendix shows the application of cinematography to the recording and analysis of neurological and developmental conditions. The use of behavior films for the study of normal and clinical child development is indicated.

The cinema of course is not indispensable; but for the student who wishes to perfect his diagnostic skill an ideal program of intensive self-instruction would consist of a combination of printed text, clinical experience, and cinematic case study.

The most effective teachers of all are the infants and children themselves; and normal subjects are available in abundance for purposeful, systematic observation. The present volume is designed to encourage such observation and to make it clinically productive.

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THE DEVELOPMENT OF BEHAVIOR

This book deals with problems of development and maturity—with the process and products of growth. Growth produces progressive changes in structure and closely correlated changes in function. The embryologist is concerned with the formation of bodily organs and systems. The physiologist is concerned with the functioning of these organs and organ systems. The clinician is interested in the individual as a whole—in the total integrated functioning and behavior of the organism at all stages of its development.

§ 1. BEHAVIOR PATTERNS AND BEHAVIOR GROWTH

We shall show how the developmental status of the infant and child can be determined by his reactions—by the way he behaves. *Behavior* is a convenient term for all his reactions whether reflex, voluntary, spontaneous, or learned. He blinks: this is a form of behavior. He reaches for a dangling object: this is a form of behavior. He turns his head to the sound of the human voice: this likewise is behavior.

The body grows; behavior grows. The infant is a growing action system. He comes by his mind in the same way that he comes by his body, through the processes of development. As the nervous system undergoes growth differentiations the forms of behavior also differentiate. At one age he seizes with his fist; at a later age, he plucks with neat opposition of thumb and index—a concrete example of the way differentiation produces specialization of function and new behavior patterns.

Growth is, thus, a patterning process. *Behavior pattern* is a valuable term which will often prove useful. There is nothing mysterious about the concept of growth; it helps, in fact, to place the work of

developmental diagnosis on a firm, objective basis. A behavior pattern is simply a defined response of the neuro-motor system to a specific situation. The eye blink, the knee jerk, the reflex grasp, are examples. In postural adjustments and in locomotion the whole body reacts. Sitting, standing, creeping, walking, also are behavior patterns. A young baby follows a dangled object with his eyes; eye following is a behavior pattern. He closes in upon the object with both hands; that is another pattern which has considerable symptomatic significance at a certain stage of development. An older baby reaches with one hand only. A yet older baby may poke a small object with his extended index finger. This again is a well defined response of the neuro-motor system to a specific situation. It is a behavior pattern symptomatic of a stage of maturity.

Development yields to diagnosis, because the construction of the action-system of infant and child is determined by lawful growth forces. Behavior patterns are not whimsical or accidental by-products. They are the authentic *end*-products of a total developmental process which works with orderly sequence. They take shape in the same manner that the underlying structures take shape. They begin to assume characteristic forms even in the fetal period, for the same reasons that the bodily organs themselves assume characteristic forms. For example: In the fourth week of gestation limb buds make their appearance. Cells proliferate to form the skeleton, muscles, blood vessels and nerves of arm, forearm and hand. The paddle-like hand transforms into a five-finger hand. At 11 weeks the fingers flex in a reflex grasp. *Formed* connections have been made between nerve fibers and muscle fibers. A behavior pattern has taken shape.

All behavior patterns both in prenatal and postnatal life take shape in a comparable manner. At about the 18th week the fetal hand grips as well as flexes. At the 40th postnatal week the infant hand extends its index finger to poke and pry. Throughout all infancy this same morphogenesis is at work, creating new forms of behavior, new and more advanced patterns. These patterns are symptoms. They are indicators of the maturity of the nervous system.

§ 2. FOUR FIELDS OF BEHAVIOR

Even a single behavior symptom, such as prying with the index finger, may have a high degree of diagnostic import. But the human

organism is a complicated action-system and an adequate developmental diagnosis requires an examination of four fields of behavior representing the different aspects of growth. These four major fields are (1) Motor behavior, (2) Adaptive behavior, (3) Language behavior, (4) Personal-Social behavior.

Motor behavior is of special interest to the physician, because it has so many neurological implications, and because the motor capacities of the child constitute the natural starting point for an estimate of his maturity. Both gross bodily control and the finer motor coordinations must be considered: postural reactions, head balance, sitting, standing, creeping, walking; prehensory approach on an object, grasp and manipulation of the object.

Adaptive behavior lends itself to similar diagnostic scrutiny. Here we reckon with the finer sensori-motor adjustments to objects and situations: the co-ordination of eyes and hands in reaching and manipulation; the ability to utilize the motor equipment appropriately in the solution of practical problems; the capacity to initiate new adjustments in the presence of simple problem situations which we set before the infant. He is bound to display significant patterns of behavior even in his exploitation of such a simple object as a hand bell. He will reveal growing resourcefulness.

Language behavior likewise assumes distinctive patterns which furnish clues to the organization of the infant's central nervous system. We use the term broadly to include all visible and audible forms of communication, whether by facial expression, gesture, postural movements, vocalizations, words, phrases, or sentences. Language behavior, moreover, includes mimicry and comprehension of the communications of others. Articulate speech is a socialized function which requires social milieu but which, nevertheless, depends upon the readiness of sensori-motor and cortical structures. Preverbal phases prepare for the verbal. Inarticulate vocalizations and vocal signs precede words. The underlying stages are as orderly and inevitable as those observed in the fields of motor and adaptive behavior.

Personal-social behavior comprises the child's personal reactions to the social culture in which he lives. These reactions are so multitudinous, so variegated and contingent upon environment, that they would seem to be beyond the reach of developmental diagnosis. But

here as elsewhere we find that the patterning of behavior is fundamentally determined by intrinsic growth factors. Bladder and bowel control, for example, are cultural requirements; but their attainment depends primarily upon neuro-motor maturity. So with a large number of the child's abilities and attitudes: his feeding abilities, his sense of property, his self-dependence in play, his co-operativeness, his responsiveness to training and to social conventions. Personal-social behavior is particularly subject to individual variations, but these variations have normal limits.

§ 3. The Developmental Diagnosis of Behavior

Behavior grows. Behavior assumes characteristic patterns as it grows. The principles and practice of developmental diagnosis rest on these two simple but far-reaching propositions. Developmental diagnosis is nothing more or less than a discriminating observation of patterns of behavior and their appraisal by comparison with normative patterns. A normative pattern of behavior is a criterion of maturity which has been defined by controlled studies of the average normal course of behavior growth. A graded series of such norms of maturity serves as a measuring rod or a calibrated scale.

We cannot of course measure development with absolute precision, because there is no absolute unit of growth. We cannot quantify development in ohms, calories, or minims. But we can specify levels and degrees of development in terms of seriated maturity values.

It takes time to mature. We express the amount of time consumed by *age*. We express the actual maturity attained by equivalent behavior values. Study of hundreds of normal infants and young children has enabled us to ascertain the average trends of their behavior development. Naturally we have also noted the ranges of individual variation. But these variations cling closely to a central average. We find also that the sequences of development, i.e., the order in which behavior patterns appear, is significantly uniform. Consequently we think of behavior in terms of age, and we think of age in terms of behavior. Developmental diagnosis translates behavior values into age values. Normative behavior patterns are used to identify and to evaluate the behavior which a child displays.

To illustrate, let us place a small sugar pellet in front of a baby.

The baby is sitting up (with support) and the pellet is in easy reach on a table surface. He rakes at the pellet with a scratch-like flexion of his fingers. Another baby is presented with the same behavior test. He approaches the pellet with extended index finger and plucks it forceps-like between index and thumb. How shall we evaluate the maturity status as evidenced by these two behavior patterns? We should say that the raking reaction is cruder than the plucking reaction. But this tells us nothing about the actual maturity of the responses. If we consult the notches in our normative measuring rod, we find that the raking reaction is characteristic (typical and normal) of an average 28-week-old infant, and that plucking is characteristic (typical and normal) of an average 40-week-old infant. Developmental diagnosis is an appraisal of observed patterns in terms of normative patterns. Accordingly, if the baby who raked was chronologically 40 weeks old, he certainly is either defective or retarded with respect to prehensory maturity. If he was 28 weeks old, all is well and good for the area of behavior which is sampled and assayed by this particular prehension test. It is a highly effective test for the diagnosis of fine motor co-ordination.

But a clinical diagnosis never rests on an isolated test. The whole body of behavior needs to be sampled by a fair variety of tests. This system of developmental diagnosis, therefore, will describe appropriate test situations for each of the four major fields of behavior. Normally (that is on the average) motor, adaptive, language, and personal-social behavior develop more or less abreast. The four fields are closely related and they overlap; but in atypical, deviated, or defective development they often show discrepancies. A child may be advanced in one field and relatively retarded in another. One task of developmental diagnosis is to discover and to specify such imbalances. The normative behavior patterns enable us to formulate what we see in the total behavior picture which the child presents. Our objective is to render a description in terms of maturity levels; this forms the basis for an interpretation of developmental status.

Development is a continuous process. In complicated and doubtful conditions it may be necessary to make two or even more examinations at successive ages in order to determine the tempo and the

trend of the child's development. We may examine him at 28 weeks, and then again at 40 weeks to see whether the two successive behavior pictures comport with each other. We compare the child with himself, or more accurately, we compare two cross-sectional determinations of his maturity at two distinct ages. Developmental diagnosis is an orderly critical method of comparison. It is a matching of observations and of norms. When the matching is guided by ample clinical experience, it has the validity of true measurement.

Normative criteria are set forth elsewhere in this volume, descriptively, in tabulated schedules, and in photo-diagrams of action patterns. Needless to say norms of development are also abundantly illustrated in the normal infants whom one sees in everyday life and in professional life.

§ 4. STAGES AND SEQUENCES OF DEVELOPMENT

Before describing diagnostic procedures it will be profitable to take a bird's-eye view of the territory which is to be explored by the developmental examination. Development is a continuous process. Beginning with conception it proceeds stage by stage in orderly sequence, each stage representing a degree or level of maturity. There are so many such levels that we must select a few which will serve best as a frame of reference for purposes of diagnosis. We have determined upon the following *Key Ages*: 4, 16, 28, 40 weeks; 12, 18, 24, 36 months.

To appreciate the developmental significance of these key ages it is well to examine their position in the early cycle of human growth. This cycle is depicted in the five charts which follow. The first chart gives a comprehensive view of the entire scope of development; it includes the fetal period, to indicate the continuity of the growth cycle.

The organization of behavior begins long before birth; and the general direction of this organization is from head to foot, from proximal to distal segments. Lips and tongue lead, eye muscles follow, then neck, shoulder, arms, hands, fingers, trunk, legs, feet. The chart reflects this law of developmental direction; it also suggests that the four distinguishable fields of behavior develop conjointly in close co-ordination.

LEVELS
of
MATURITY

5 YEARS — — — — — — — → Sociality: Kindergarten
4 YEARS — — — — — — → Concepts: Number, form
3 YEARS — — — — → Speech: Sentences
2 YEARS — — — → Sphincters: Bladder & bowel control
18 MONTHS — — → Larynx: Words, phrases
12 MONTHS — → Legs, feet: Stands, cruises
40 WEEKS → Trunk, fingers: Sits, creeps, pokes
28 WEEKS → Hands: Grasp and manipulation
16 WEEKS → Head: Balance
4 WEEKS → Eyes: Ocular control
0 BIRTH
40 WEEKS → Viscera: Vegetative functions

SOCIAL BEHAVIOR
PERSONAL - SOCIAL BEHAVIOR
LANGUAGE BEHAVIOR
ADAPTIVE DEVELOPMENT
MOTOR DEVELOPMENT

ZONE OF PRE-TERM VIABILITY

24 WEEKS → Autonomic system: Physico-chemical control
20 WEEKS → Tonic-neck-reflex, quickening
18 WEEKS → Hand closure, grip
16 WEEKS → Pre-respiratory movements
14 WEEKS → Swallow, sneer, Babinski reflexes
10 WEEKS → Trunk extension
8 WEEKS → Fetal stage: Trunk flexion, oral sensitivity
1 WEEK → Embryonic stage: Pre-neural organization
0 → Conception: Germinal organization

FIG. 1. The development of behavior in the four major fields.

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In terse terms the trends of behavior development are as follows:

In the *first quarter* of the first year the infant gains control of his twelve oculomotor muscles.

In the *second quarter* (16-28 weeks) he comes into command of the muscles which support his head and move his arms. He reaches out for things.

In the *third quarter* (28-40 weeks) he gains command of his trunk and hands. He sits. He grasps, transfers and manipulates objects.

In the *fourth quarter* (40-52 weeks) he extends command to his legs and feet; to his forefingers and thumb. He pokes and plucks.

In the *second year* he walks and runs; articulates words and phrases; acquires bowel and bladder control; attains a rudimentary sense of personal identity and of personal possession.

In the *third year* he speaks in sentences, using words as tools of thought; he shows a positive propensity to understand his environment and to comply with cultural demands. He is no longer a mere infant.

In the *fourth year* he asks innumerable questions, perceives analogies, displays an active tendency to conceptualize and generalize. He is nearly self-dependent in routines of home life.

At *five* he is well matured in motor control. He hops and skips. He talks without infantile articulation. He can narrate a long tale. He prefers associative play; he feels socialized pride in clothes and accomplishment. He is a self-assured, conforming citizen in his small world.

The remaining four charts diagram the sequences of development in Motor, Adaptive, Language, and Personal-Social fields of behavior. These four fields develop interdependently: and an adequate estimate of behavior maturity demands an appraisal of each major field. Each chart shows selected behavior patterns which illustrate the progressions of normal development. These patterns give a preliminary suggestion of the practical application of behavior norms.

*

LEVELS
of
MATURITY

5 YEARS ⎯⎯⎯⎯⎯→ Skips on alternate feet.

4 YEARS ⎯⎯⎯⎯→ Skips on one foot.

3 YEARS ⎯⎯⎯→ Stands on one foot. Builds tower of 10 cubes.

2 YEARS ⎯⎯→ Runs. Builds tower of 6 cubes.

18 MONTHS ⎯→ Walks without falling. Seats self. Tower of 3 cubes.

12 MONTHS ⎯→ Walks with help. Cruises. Prehends pellet with precision.

40 WEEKS → Sits alone. Creeps. Pulls to feet. Crude prehensory release.

28 WEEKS Sits, leaning forward on hands. Grasps cube. Rakes at pellet.

16 WEEKS Head steady. Symmetrical postures. Hands open.

4 WEEKS Head sags. T-n-r. Hands fisted.

BIRTH

FIG. 2. Developmental sequences of motor behavior.

The items on this chart include both gross motor and fine motor behavior patterns. To ascertain the maturity of postural control we institute formal postural tests which reveal the repertoire of the infant's behavior: supine, prone, sitting, and standing.

Fine motor control is evaluated in a similar manner. Small objects such as cubes, pellet and string elicit patterns of fine manual control.

Such tests illustrate the principles which also underlie the developmental diagnosis of behavior in the adaptive, language, and personal-social fields.

LEVELS
of
MATURITY

5 YEARS _____→   Counts 10 pennies.

4 YEARS _____→   Builds gate of 5 cubes. Draws "man."

3 YEARS _____→   Builds bridge of 3 cubes. Imitates cross.

2 YEARS _____→   Builds tower of 6 cubes. Imitates circular stroke.

18 MONTHS _____→   Dumps pellet from bottle. Imitates crayon strokes.

12 MONTHS _____→   Releases cube in cup.

40 WEEKS _____→   Combines 2 cubes.

28 WEEKS   Transfers cube from hand to hand.

16 WEEKS   Competent eye following. Regards rattle in hand.

4 WEEKS   Stares at surroundings. Restricted eye following.

BIRTH —

FIG. 3. Developmental sequences of adaptive behavior.

To determine how the infant uses his motor equipment to exploit the environment we present him with a variety of simple objects. The small red cubes serve not only to test motor co-ordination, they reveal the child's capacity to put his motor equipment to constructive and adaptive ends. The cube tests create an objective opportunity for the examiner to observe adaptivity in action—motor co-ordination combined with judgment.

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LEVELS
   of
MATURITY

 5 YEARS   _____⟶        Speaks without infantile articulation. Asks "Why?"
 4 YEARS    _____⟶         Uses conjunctions. Understands prepositions.
 3 YEARS     _____⟶          Talks in sentences. Answers simple questions.
 2 YEARS      _____⟶          Uses phrases. Understands simple directions.
18 MONTHS _____⟶        Jargons. Names pictures.
12 MONTHS ___⟶          Says 2 or more words.
40 WEEKS   _⟶           Says one word. Heeds his name.
28 WEEKS              Crows. Vocalizes eagerness. Listens to own vocalizations.
16 WEEKS             Coos. Laughs. Vocalizes socially.
 4 WEEKS            Small throaty sounds. Heeds bell.
  BIRTH   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
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FIG. 4. Developmental sequences of language behavior.

Language maturity is estimated in terms of articulation, vocabulary, adaptive use and comprehension. During the course of a developmental examination spontaneous and responsive language behavior is observed. Valuable supplementary information may also be secured by questioning the adult familiar with the child's everyday behavior at home.

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LEVELS of MATURITY

5 YEARS	Dresses without assistance. Asks meanings of words.
4 YEARS	Can wash and dry face. Goes on errands. Plays cooperatively.
3 YEARS	Uses spoon well. Puts on shoes. Takes turns.
2 YEARS	Verbalizes toilet needs. Plays with dolls.
18 MONTHS	Uses spoon with moderate spilling. Toilet regulated.
12 MONTHS	Cooperates in dressing. Gives toy. Finger feeds.
40 WEEKS	Plays simple nursery games. Feeds self cracker.
28 WEEKS	Plays with feet and toys. Expectant in feeding situations.
16 WEEKS	Plays with hands and dress. Recognizes bottle. Poises mouth for food.
4 WEEKS	Regards faces.
BIRTH	

FIG. 5. Developmental sequences of personal-social behavior.

Personal-social behavior is greatly affected by the temperament of the child and by the kind of home in which he is reared. The range of individual variation is wide. Nevertheless maturity factors play a primary role in the socialization of the child. His social conduct is ascertained by incidental observation and by inquiry. The chart illustrates types of behavior which may be considered in evaluating the interaction of environmental influences and developmental readiness.

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CHAPTER II

THE DEVELOPMENTAL EXAMINATION OF BEHAVIOR

All forms of clinical pediatrics, neurology, and psychiatry which are concerned with the developmental welfare of infants and of young children must take behavior patterns into account. Behavior patterns are symptoms. A developmental diagnosis is essentially an appraisal of the maturity of the nervous system with the aid of behavior norms.

§ 1. THE OBSERVATION OF BEHAVIOR DEVELOPMENT

In the first years of life it is particularly important that case histories of children should include concrete dated observations of behavior capacities and of behavior growth. There are three ways in which such behavior data can be secured: by interview, by a single formal examination, and by periodic supervisory examinations.

An interview is a natural and necessary preliminary to a formal behavior examination. It involves a brief but incisive cross-questioning of the parent or adult familiar with the child's everyday life. Methodically undertaken, the interview becomes a productive inventory which will supply at least a few concrete items in each of the four major fields of behavior, namely: Motor, Adaptive, Language, Personal-Social Behavior. A minimal behavior inventory should be regarded as an essential feature of nearly every case history, whether taken at home, in the doctor's office, or on a hospital ward. It should become routine. The techniques for conducting a productive interview are considered in Chapter IV.

Interview and history taking, however, are no adequate substitute for a direct observation of the child's behavior status. Precise ob-

servation demands a formal examination. Such examination is indispensable in all conditions which require a differential developmental diagnosis; that is, all cases which present neurological complications, difficult birth history, retardation, mental defect, behavior disorders, or problems of child adoption and institutional commitment.

Chapter III outlines the behavior test situations and the general procedures which are used in the formal examination of infants and young children from 4 weeks through 3 years of age. Specific test procedures for the individual behavior situations will be detailed in Appendix A.

A single behavior examination does not always suffice. In most cases of developmental defect and deviation, it is desirable to reappraise the child's progress from time to time. This requires periodic supervisory examinations, which will bring a series of diagnoses into cumulative comparison.

Such a form of developmental supervision also has an important place in the protection and preventive care of normal children. It may be readily incorporated into the supervision of infant feeding and the periodic health examinations made by the pediatrician and general practitioner.

§ 2. Examination Arrangements

First of all let us remove any false mystery which may still attach to the idea of making a formal examination of an infant's behavior. The physician is not here asked to derive an I.Q. or even a mental age. He is not called upon to measure intelligence as such. He is concerned with maturity and health. He is exercising his responsibility of protecting the total growth of the child under his care. As a means of effecting this protection he makes a simple, analytic examination of behavior status.

The arrangements for a developmental examination of behavior require only a slight adaptation of conventional office furniture. The minimal physical requirements are (a) a free flat surface on which the child may display postural and other motor capacities; (b) the restricted surface of a small test table on which test toys are placed to elicit adaptive behavior. At the early ages the top of an ordinary examining table provides the flat surface on which the

infant lies, sits, or stands. A low portable test table, similar to a bed tray, placed on the examining table, supplies the working surface for the presentation of test objects. At later ages the examination shifts to floor level, and the child is provided with a nursery size chair and table. The floor then becomes the arena for displaying postural control.

This general statement of minimal essentials (with its emphasis on *surfaces*) serves to remind us of an important basic principle, namely, that the physical surfaces which impinge upon the child are part and parcel of the examination set-up. They are the surroundings which must not be taken for granted nor overlooked. They are part of the stimulating apparatus. From the standpoint of behavior diagnosis we wish to know how the child reacts to the stimulus of horizontal and vertical surfaces; of restricted and unrestricted surfaces; and of objects in relation to surfaces. Even when we place a young infant on his back we are making a behavior test. We observe his spontaneous reactions to all the stimuli which arise in this situation, including the tactile pressures of the surface on which he lies. This principle applies to all stages of postural control.

The accompanying sketches show how the examination arrangements are adapted to the ascending grades of postural control: supine, supported sitting, free sitting, chair sitting. These arrangements are simple but effective. A more elaborate set-up would include a supportive examining chair, and a special examining crib, as described in Appendix C.

The test materials required for a developmental examination also are simple and are readily contained in a kit or a table drawer. The full complement of test objects is pictured in Figure 7. In most instances the objects are presented on the test table singly, in a prescribed order. A few objects are presented while the child is in the supine position, or while he is on his feet.

The child reacts to these objects as though they were play materials. So they are; but *for the physician they constitute controlled devices for eliciting patterns of behavior indicative of developmental status.* One must think of test materials and physical surfaces as areas of simulation which excite the infant's nervous system to symptom responses.

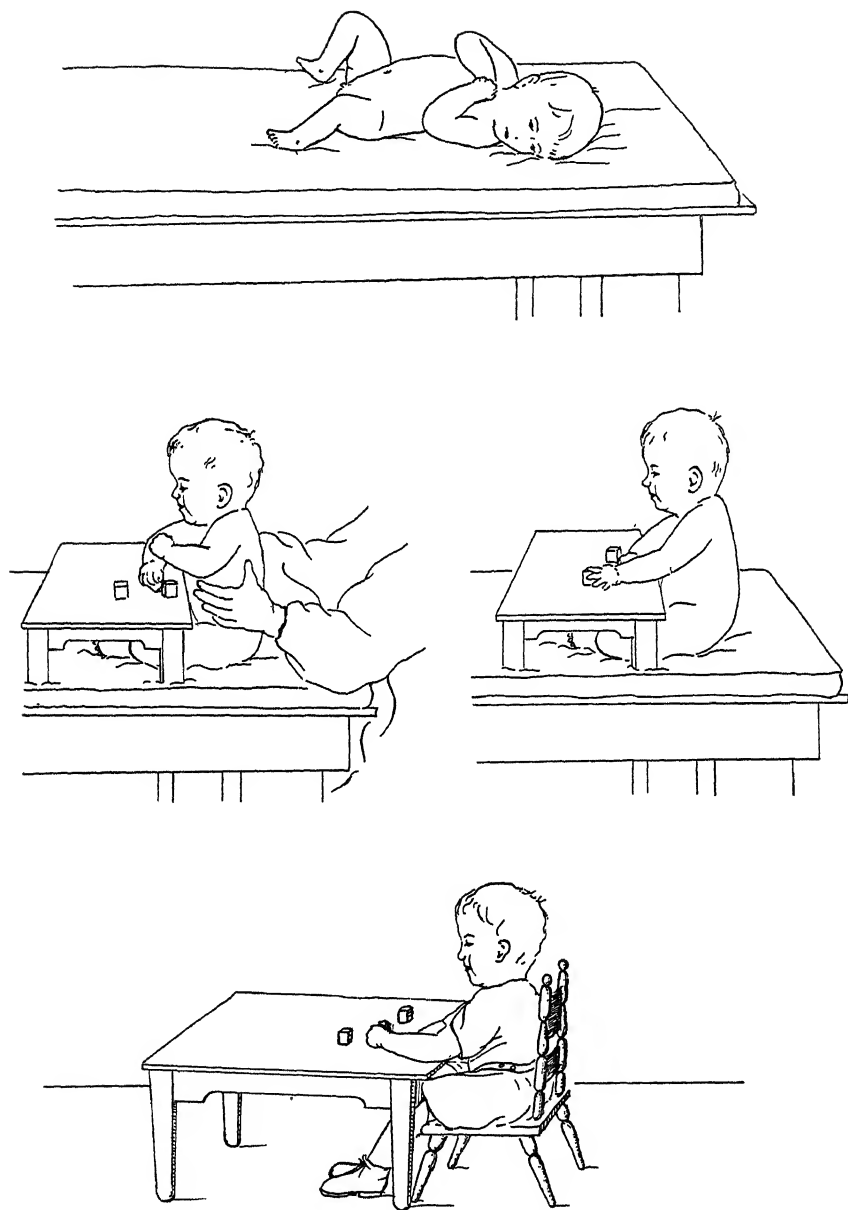The stimulus values of a test object are, of course, influenced by

FIG. 6. Examination arrangements adapted to advancing grades of postural maturity: supine, supported sitting, free sitting, and chair sitting.

the manner in which the object is presented to the child. The object must not be presented too abruptly. Distractions are reduced to a minimum, and the examiner takes a somewhat retired position at the baby's side, so that the baby's attention will favor the working surface of the test table. On this surface the examiner places the test objects within easy reach for exploitation. The presentation is accomplished in a quiet, restrained manner which is calculated and timed to focus the baby's attention on the object.

The following chapter (Chapter III) with the aid of action pictures outlines concretely the test procedures employed at each of the key ages. Although the examinations are adapted to the maturity of the child, it will be noticed that there is a fundamental continuity in the method of approach. Each examination takes from ten to twenty minutes, and in that brief time explores in an orderly way the varied functions of which the child is capable: general body control, prehension, visual perception, hearing, eye-hand co-ordination, manipulation, exploitiveness, vocalization, and social reactions. The whole examination is designed to elicit the behavior responses which are most significant for an estimate of the maturity status of the nervous system. Each test object is applied as though it were a specialized tool charged with specific stimulus powers. (Strictly speaking it is the child who is charged with the various forms of reactiveness; the test materials are activators which release discharges of patterned energy.)

Let us illustrate this important principle by describing the stimuli or incitements which are latent in a few typical test objects and test situations.

Cubes. The red wooden one inch cubes have almost universal appeal throughout infancy and early childhood. Their color, size, shape, weight and texture release the very reactions which we wish to elicit: grasping when placed in the infant hand (4 weeks); ocular fixation when placed on the table (16 weeks); prehension on sight by palmar grasp (28 weeks); prehension by digital grasp (40 weeks). The cube does not change its configuration from age to age but it does alter the configuration of the child's reactions, the very thing in which we are interested. The geometric shape of the cube helps us to differentiate between shapes of behavior,—between gross and fine prehension (e.g. palmar and digital grasp).
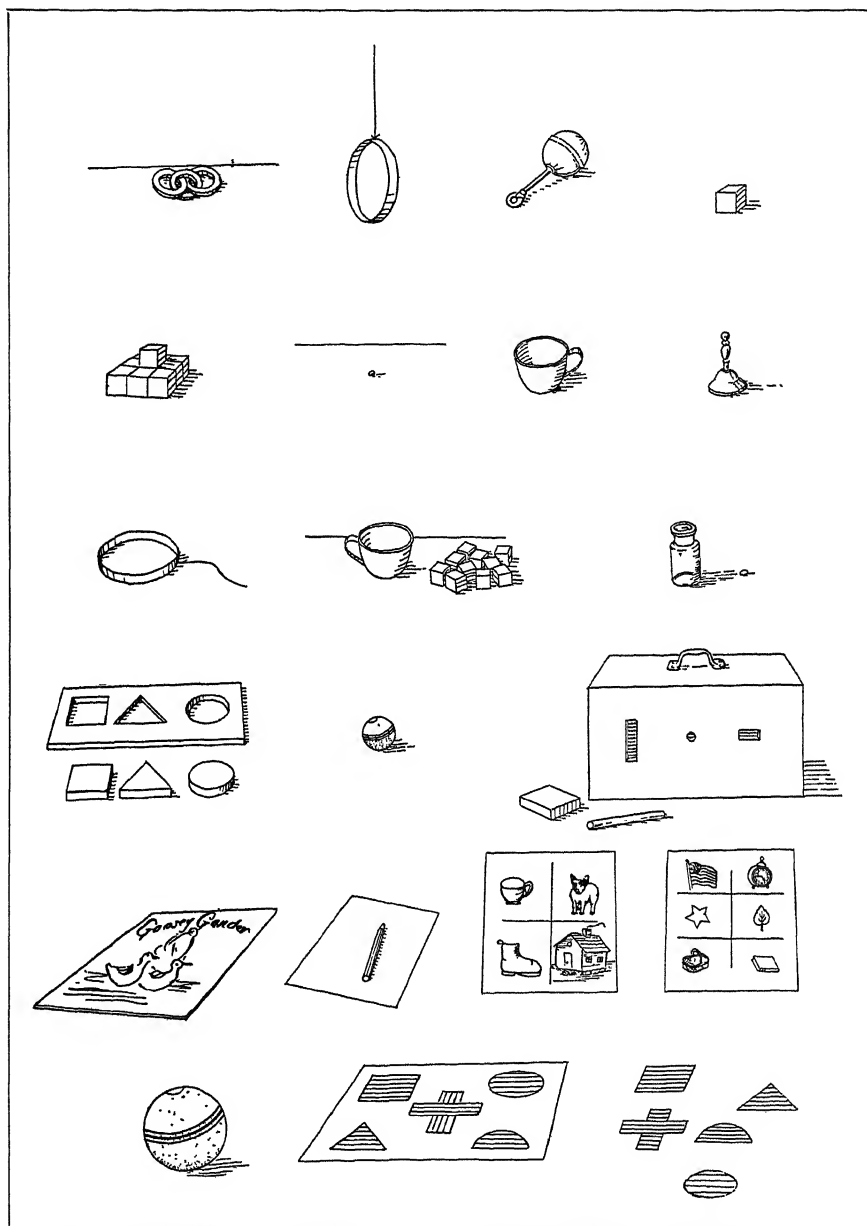
FIG. 7. Examination materials: Tricolored rings, dangling ring, rattle, cube, massed cubes, pellet, cup, bell, ring and string, cup and cubes, pellet and bottle, formboard, ball, performance box with block and rod, picture book, paper and crayon, picture cards, large ball, color forms.

The *pellet* likewise serves to differentiate more refined ocular fixation, and to establish progressive grades of thumb opposition. Being tiny and round it holds distinctive stimulus values.

The cube is moreover competent to excite various forms of increasingly sophisticated exploitation, such as banging, mouthing, biting, inspection, brushing, releasing, casting. These increasing refinements of exploitation are so many clues to the increasing refinements in the organization of the nervous system.

We present the cubes singly, consecutively (1, 2, 3), in a cluster of 10, and in constructed models for imitation. This enormously multiplies the stimulus values of the cubes and unlocks the answers to many psychoneurological questions: Can the child retain one cube and still give heed to a second cube? Can he retain two cubes and attend to a third? Can he bring two cubes into relationship (or does he exploit one with exclusive preoccupation)? Can he place a cube in a container (the cup)? Can he release it? If he has a realization of container and contained, has he also an appreciation of "on top of," and "side by side"? Does he perceive spatial relationships sufficiently so that he can erect a tower, lay a wall, and build a bridge? At 4 weeks he can merely grip a cube when it is thrust into his palm. At 3 years he can build a bridge from a model. The cubes, therefore, constitute a powerful instrument for establishing developmental gradients which lie between 4 weeks and 3 years.

Bell. This is another test object which is sufficiently diversified in its physical make-up to disclose symptomatic gradations of response. Its make-up comprises a cylindrical handle, a conical bowl, a swinging lever (the clapper); optically a contrast in dark handle and silvery metal; tactually a hard rim; statically a low center of gravity; a right-side-up; a sound-effect for the ears. The very construction of the bell induces transfer from hand to hand, gross mouthing of the nipple-like end of the handle; and even drinking from the bowl. It also induces inquisitive exploration by eyes and fingers. As the child matures he pays differentiating attention to the varied components of the bell. Does he seize the bell grossly at the junction of handle and bowl? Or does he grasp it digitally at the top of the handle? Does he place it vertically on the table top? Does he thrust out his index finger to investigate clapper and cavity? Does he heed sound

by bodily immobilization? Or by head turning? Does he spontane-
ously initiate the sound by waving the bell?

To the perspicacious examiner the bell is not merely a bell. It
is a complex thing of many facets. It is a touchstone which divulges
the neurological facets of the child.

Pellet and bottle. When we place a pellet beside a bottle we are
not simply instituting a performance test to elicit success or failure.
We are creating a behavior situation surcharged with rival stimuli
which are bound to evoke revealing responses. The responses will
evidence the infant's interests, the span of his attention and the
course of his attention. Does the attention go exclusively to the bot-
tle, or is he more interested in the pellet? Does he comprehend the
relationship of container and contained? Does he comprehend the
glass barrier? Does he adaptively tilt the bottle to expel the pellet?
Etc. Once the examiner conceives of test objects as touchstones effec-
tive for neurological analysis, every object which the child exploits,
be it cube, pellet, paper, string, or cereal, will take on diagnostic
significance.

Play pen. A play pen is a test object, just as truly as is the pellet.
It arouses the gross musculature rather than accessory musculature
of finger and thumb. Nevertheless it is a configured entity in a physi-
cal world. It presents a circumscribed horizontal flat surface and
four panels of vertical surface. Does the infant prefer the horizontal
or the vertical? How does he adapt to the vertical? How does he
deploy his hands and feet if he assumes an upright posture? What is
his stance? What are his powers of aided and unaided locomotion?

Ball. The ball, like the cube, is a basic test object, but it has physi-
cal properties quite unlike the cube; it has a minimum of stability.
We capitalize its mobility by making it a medium of social inter-
change between examiner and child. In the give and take of to-and-
fro ball play a supercharged social situation is set up, in which the
examiner himself becomes a kind of test object. The ball thereby
becomes a device for revealing not only the motor aptitudes of the
infant but also the maturity of his social behavior.

By virtue of their simplicity the test objects have intrinsic appeal.
They are almost self-operative. When presented with due deference,
freedom and control they give the child an ample opportunity to
reveal his dynamic make-up and his neuro-motor organization.

CHAPTER III

NORMS OF DEVELOPMENT

To grasp the characteristics of child development we must think in terms of behavior patterns, maturity stages, and growth trends. The present chapter is organized to facilitate such thinking. It gives a panoramic view of the total stream of development in the first three years of life. It also supplies a cross-sectional view of that stream at eight strategic points or *key ages*, namely 4, 16, 28, and 40 weeks; 12, 18, 24, and 36 months. These key ages hold a prominent place in developmental diagnosis. They represent the basic stages of maturity to which observed behavior can be referred for appraisal. By limiting the number of key ages to eight we have greatly simplified the task of the examiner. When he masters the characteristics of these ages, he will be oriented. He will have bearings from which he can reckon.

Eight cross-sectional views are graphically presented in the form of action pictures which portray the patterns of behavior diagnostically significant for each of the key ages. The pictures are authentic tracings of action patterns of actual children as recorded by cinema. These patterns of behavior are representative. They are normative. They typify the kinds of reaction elicited by developmental examination. The course and content of the examination at each key age are succinctly set forth in the letter text which accompanies the pictures.

Inasmuch as the pictures and the examinations can provide only a cross-sectional view, it is important to recognize the growth trends which produce the behavior patterns and which alter the form of these patterns as the infant matures. Accordingly each age interval carries a brief characterization of the lines of development. Some of the lines are traced backward; others are traced forward. The

growth trends show how new behavior emerges, how one pattern of behavior is replaced by another. By following these lines of growth we are in a better position to understand the meaning of any observed behavior. It is especially advantageous to consider a key age in relation to the two age levels immediately adjacent—the next younger and the next older.

Accordingly for each key age in turn we present a developmental schedule, which in three vertical columns lists the behavior characteristics of the key age and its two adjacent ages. The key age occupies the central column. Horizontally, the behavior characteristics are listed with reference to the four major behavior fields. This arrangement permits ready cross-comparison in terms of kinds of behavior as well as levels of maturity.

The behavior patterns which are arrayed in a single age column should not be read as isolated items. They are closely correlated and should be considered as a compact organic characterization of the behavior typical for that age.

The behavior portraits inherent in the developmental schedules are the diagnostic criteria for evaluating observed behavior. Two kinds of behavior patterns appear on these schedules: (1) *permanent patterns* which come in to stay or augment; (2) *temporary patterns* which give way or transform into different and more advanced patterns at later ages. A child builds a tower of 2 at 15 months; a tower of 3 at 18 months. This is clearly a permanent type of behavior pattern. An infant of 12 weeks sits with bobbing head; at 16 weeks he sits with head steady. Steadiness supersedes bobbing. Bobbing is a temporary pattern. Steadiness is a permanent pattern. Temporary patterns are indicated on the schedules by an asterisk followed by the age at which the pattern is replaced by a more mature pattern of the same nature. A complete tabulation of the temporary patterns and superseding patterns may be found in Appendix A, § 5. A serial reading of this tabulation will give a concrete impression of the process of developmental organization.
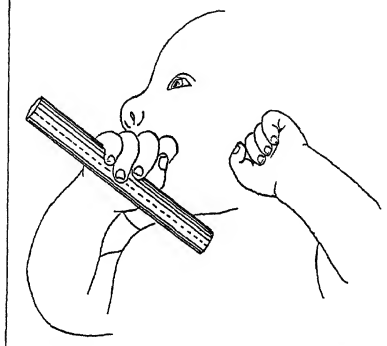
The present chapter serves two practical purposes: (1) It affords a bird's-eye view of the total span of early child development; (2) it furnishes a guide for defining the behavior examination, for identifying observed behavior patterns, and for interpreting their developmental significance in terms of key ages. To emphasize the continuity

of development and the essential similarity of examination methods, each key age is treated in the same manner, as follows: (a) action drawings portray characteristic behavior patterns; (b) the associated text gives a condensed narrative picture of the developmental examination and of typical behavior. *The text specifies (in italics) all behavior which characteristically appears for the first time at each key age.* (c) A summary of growth trends delineates the drift of the developing behavior; (d) finally a developmental schedule codifies the behavior patterns for diagnostic application.

With the key ages well in mind, the student will have the working knowledge of normal development necessary for an understanding of defects and deviations. The key ages correspond to four developmental periods or maturity zones as follows:

Key Ages	*Maturity Zones*
4 weeks⎫ 16 weeks⎰	................Supine
28 weeks⎫ 40 weeks⎰	................Sitting
12 months⎫ 18 months⎰	................Locomotor
24 months⎫ 36 months⎰	................Pre-kindergarten
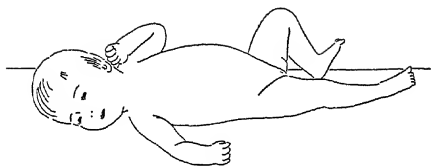
4 WEEKS

1. Tonic-neck-reflex attitude (t-n-r)
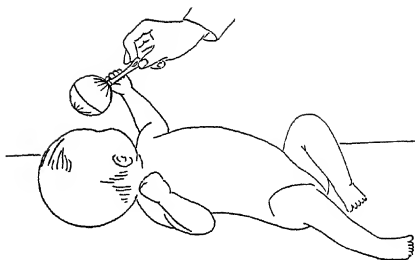
5. Hand clenches on contact
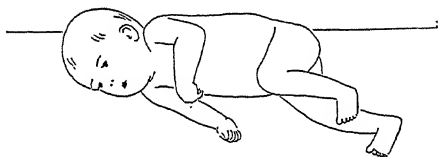
2. Rolls partway to side
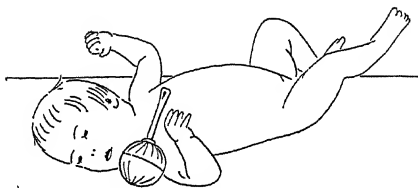
6. Drops rattle immediately
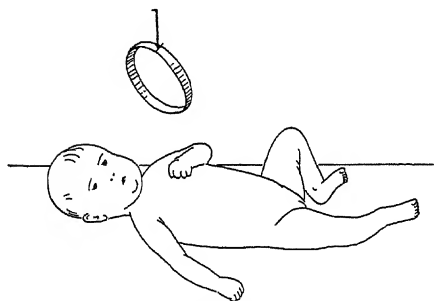
3. Disregards ring in midplane
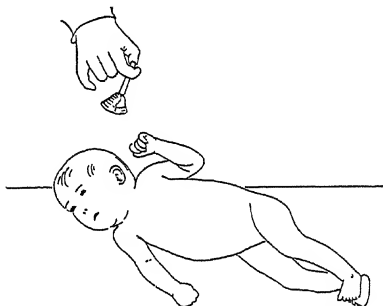
7. Attends bell; activity diminishes
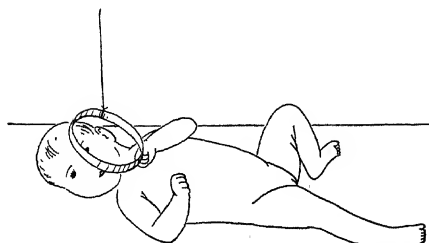
4. Eyes follow ring toward midplane

8. Marked head lag

28
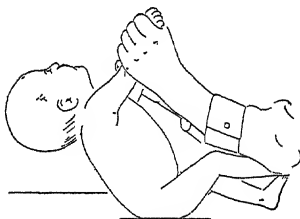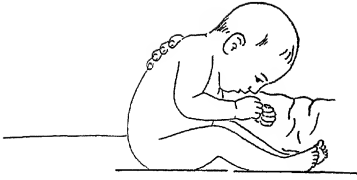
9. Head sags forward, back evenly rounded
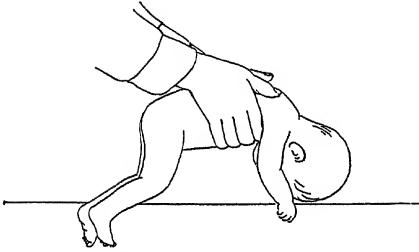
10. Ventral suspension: head droops

11. Head rotation; kneeling; crawling movements

12. Lifts head momentarily to Zone I

We like to examine the 4-week-old infant at the most opportune time when he is neither drowsy nor hungry. Even so his expression wears a remote detachment. His spontaneous *regard is starey and vague*, and remains so when he is placed in the SUPINE position for observation. He lies in the tonic neck reflex (t-n-r) attitude (1): the *head turned* far to the side, one arm in extension to the same side, the other arm flexed close to shoulder or occiput. The *hands* are tightly *fisted*. Sometimes one hand goes to the mouth. The legs are flexed in external rotation with heels on the table. When active he makes more or less symmetric *windmill movements* extending one or both arms sharply in the head-shoulder region. He *flexes and extends* the legs, *lifting them* an inch or two. Due to his rounded back, he may *roll partway* to the side (2). He looks at distant wall or window with *passive gaze*.

He disregards the DANGLING RING in the midplane (3). When the ring is brought into his *line of vision* he regards it; when it is slowly moved from the side toward the midplane again, he *pursues it* (4) with combined eye and head movements through an *arc of* 90°, and then the head returns to its preferred side position.

The RATTLE also is disregarded in the midplane and only *momentarily regarded* in the line of vision. When the handle of the rattle is touched to the fisted fingers he *clenches* his fist (5), and the fingers must be pried open to receive the rattle. He *drops it immediately* (6).

The examiner then rings a hand BELL sharply, a few inches from the ear; the baby heeds and *activity ceases or lessens* (7).

The examiner now confronts the baby preparatory to the PULLED-TO-SITTING test, shifting the baby's position if necessary. The examiner bends over and smiles and talks by way of SOCIAL approach. The baby responds by *immobilizing his activity* and he *regards the examiner's face*. By gentle maneuvers the examiner now institutes a few postural tests to determine muscular tonicity and motor response. He takes hold of the baby's hands and exerts a tentative pull toward the perpendicular (sitting position) to note the degree of head control. The pull is not completed because at this age the head falls back with *complete or marked lag* (8).

When placed in the supported SITTING

29

position the baby's head *prevailingly sags* (9) forward on his chest, but he may *erect the head momentarily.* The back is *evenly rounded* (9).

In the STANDING position, supported around the chest under the axillae, the legs *extend briefly,* the toes flex, but *resistance* to the table surface is *slight or wanting.*

The baby is then held suspended above the table in PRONE orientation. The head droops (10), showing *no postural compensation.* He is lowered to the table in prone, and just as he is placed down, the baby *rotates the head* (11), so that he rests on the cheek. The arms are flexed close to the head, and the legs are in a *kneeling position* with the *pelvis raised* (11). He extends and draws up his legs in *crawling movements* (11). If the examiner gently turns the head to the midposition, the baby *rears the head* just clear of the table surface (*Zone I*) (12) and returns it to the side.

VOCALIZATIONS are confined to *small throaty sounds.* The mother REPORTS that the baby *startles easily* to sudden sounds or movements, sometimes without external cause, and that he requires *two feedings* during the *night.*

Normative Behavior characteristic of the KEY AGE: 4 WEEKS and adjacent age levels is codified by the *Developmental Schedules* shown on the adjoining page.

DEVELOPMENTAL SCHEDULES

Fetal Infancy	KEY AGE: 4 Weeks or less	8 Weeks
For developmental behavior items characteristic of the period of fetal infancy see the *GROWTH TREND CHART* page 303.	*Motor* Su : side position head predominates (*12w) Su : t-n-r (assym.) postures predominate (*16w) Su : rolls partway to side (*8w) P. Sit : complete or marked head lag (*8w) Sit : head predomin. sags (*8w) Pr : head droops, ventral suspension (*8w) Pr : placement, head rotates (*8w) Pr : lifts head Zone I, momentarily Pr : crawling movements (*8w) Su : both hands fisted (*12w) Ra : hand clenches on contact (*8w)	Sit : head predom. bobbingly erect (*16w) Pr : head compensates ventral suspension Pr : head in midposition Pr : lifts head Zone II, recurrently (*12w)
	Adaptive D. Ring, Ra : regards line vision only (*8w) D. Ring : follows to midline Ra : drops immediately (*8w) Bell-r : attends, activity diminishes (*24w)	D. Ring : delayed midline regard (*12w) D. Ring : regards Ex. hand D. Ring : follows past midline Ra : retains briefly Bell-r : facial response (*24w)
	Language Express : impassive face (*8w) Express : vague, indirect regard (*8w) Vo : small throaty noises (*8w)	Express : smiles (social) Express : alert expression Express : direct, definite regard Vo : single vowel sounds -ah, eh, uh (*56w)
	Personal-Social So : regards Ex. face, activity dimin. (*8w) Su : stares indefinitely at surround. (*8w) Feeding : 2 night feedings (*8w)	So : facial social response So : follows moving person Su : regards Ex. Feeding : only 1 night feeding (*28w)

FOUR WEEKS: Growth Trends

Infant behavior always shows developmental trends. It has a past and it is advancing toward a future. The characteristics of 4-week behavior become more significant if we glance backward to its beginnings and forward to the 16-week age level.

Much of the behavior of the neonate (from birth to 4 weeks) is suggestive of earlier fetal stages. The neonate is not fully prepared for the demands of postnatal life. Hence his physiological ineptitudes. His respirations may be irregular, his temperature regulation unsteady. Peristalsis and swallowing are under precarious directional control. He startles, sneezes, or cries on slight provocation. His thresholds are low and inconstant.

For such reasons his behavior seems variable, fitful and sketchy. He is not capable of those sustained postural sets which lie at the basis of sustained attention. His motor tensions are transient, partial and migratory. Even his wakefulness is not sharply differentiated from sleep. Rhythms of rest and activity are poorly defined; many of his reactions seem sporadic.

The organism fatigues readily because of its immaturity and because of the vast amount of correlation which must be achieved between and within visceral and sensori-motor mechanisms. Crying, drowsing, irritability, fretfulness reflect the infant's difficulties. The neonate is therefore eminently grateful for the tactile snugness and the warmth of closely wrapt blankets which revive the habitudes of fetal life.

Some of the infant's behavior harks back to ancient racial history. He makes lashing windmill movements of his arms and intensifies his grasp in a manner which suggests vestiges of arboreal grasping and clinging. For 8 weeks or more he keeps his hands fisted in his waking life. Only as he grows older do his fingers begin to relax. By 12 weeks of age they are loosely closed. At 16 to 20 weeks we see the beginnings of a new kind of grasp, true prehension,—a self-directed grasp on tactile and visual cues.

Prehension emerges out of posture. It involves a focalization of posture and a co-ordination of eyes and hands. The tonic neck reflex (t-n-r) attitude which is one of the most conspicuous behavior pat-

terns throughout the first 12 postnatal weeks almost literally paves the way for prehension. During much of his waking life the 4-week-old infant lies in this attitude which resembles a fencing stance:— his head rotated to one side, one arm extended to the same side, the other tonically flexed at the shoulder. This attitude promotes and channelizes visual fixation on his extended hand. By gradual stages it leads to hand inspection, to active approach upon an object, and to manipulation of the object. At 4 weeks the infant immediately drops a rattle inserted in his palm; but at 8 weeks he retains it briefly. At 12 weeks he both holds and glances at it. At 16 weeks he regards it prolongedly and at 20 weeks he can make a two-handed approach upon the rattle merely on sight; and can prehend it.

The t-n-r attitude therefore proves to be not a stereotyped reaction but a kind of matrix or scaffolding for the growth of patterns of prehension. The postural control of eyes and head is an important feature of these patterns. The 4-week-old infant immobilizes his roving eyes and stares indefinitely at surroundings. The range of his vision is narrowly limited by the side position of his head. But as his head becomes emancipated, the range of his vision widens. At 8 weeks it encompasses 90°; at 12 weeks, 180°. By 16 weeks his head is beginning to prefer the midline which gives him better command of the whole visual scene. Meanwhile his head station in the supported sitting position has progressed from sag, to bobbingly erect, to occasional bob, to steadily erect.

Advances in oculomotor and postural control are reflected in the scope and discriminativeness of his attention. At 4 weeks he gives attention by means of totalized reactions. He responds to the ringing of a bell by reduction of general activity. He listens massively to sounds. In much the same totalized manner a full stomach absorbs his full attention. He is very limited in his capacity to express moods and specific desires if indeed he has them. His expressive behavior like his perceptual behavior has a generalized character. But as he matures he becomes increasingly selective in his responses: the impassive countenance of 4 weeks vanishes. Expression becomes more alert at 8 weeks; regard for physical surroundings more direct and discriminating. His eyes may pick up an individual object like the examiner's hand.

His response to social surroundings also becomes more discrimi-

nating. At 4 weeks he reacts to social overtures by a reduction of general body activity; at 8 weeks his face animates; at 12 weeks he may vocalize in reply; at 16 weeks he initiates social play. By such tokens he registers personal and emotional growth as well as progressive neuro-motor organization.

Although the newborn infant displays characteristics reminiscent of the fetus, most of the behavior of the 4-week-old has a forward reference. It is pointed toward goals. It organizes and elaborates so swiftly that by 16 weeks he appears to be penetrating his environment. So at the next key age level (16 weeks) he enjoys being propped up to survey the world into which he is being domesticated. Acculturation has begun.

16 WEEKS
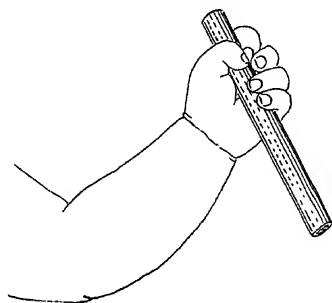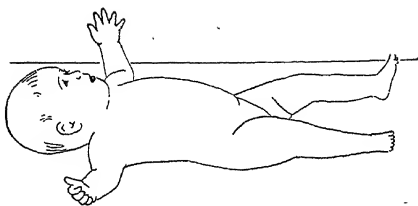
1. Symmetric posturing, head midline
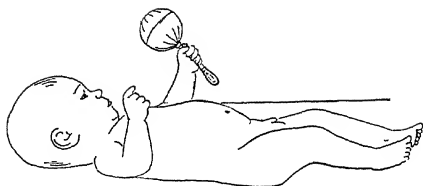
2. Hands engage at midline

3. Regards ring immediately, arms activate

4. Holds and mouths ring, free hand approaches

5. Regards rattle in hand

6. Head set forward, steady; lumbar curvature

7. Looks down at table top and hands
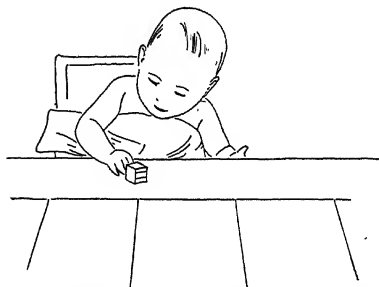
8. Looks from hand to cube; arms activate
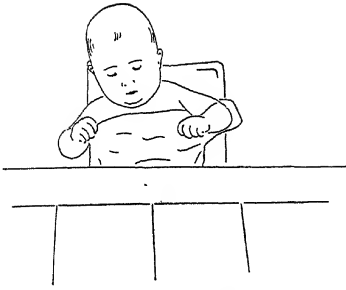
9. Regards pellet
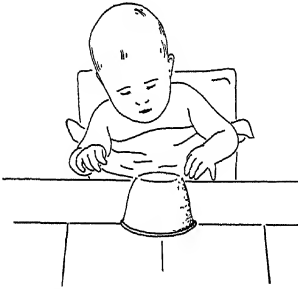
10. Looks from hand to cup; arms activate
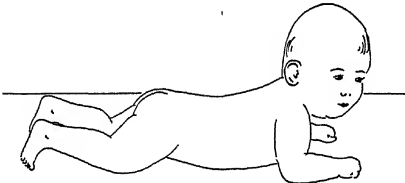
11. Holds head in Zone III, legs extended

12. On verge of rolling

The 16-week-old baby inspects persons and surroundings with much more alertness than the 4-week-old. This is due in part to the marked advance in eye and head control. Placed in the SUPINE position he spontaneously holds his *head predominantly in the midline* (1). The t-n-r attitude so characteristic of 4 and 8 weeks may be seen for brief periods, but the midposition of the head reflexly favors *symmetric postures of arms* (1), so that the *hands engage* (2) near the face or over the chest, or are flung out in lateral extension at shoulder level (1). Fingers are extended or only slightly flexed. The baby flexes and extends the legs, lifting them an inch or two. He looks at the examiner and smiles. Spontaneous hand regard is frequent because he readily fixates any object which moves into his visual field.

He *promptly regards* (3) the DANGLING RING *in the midplane* and follows the ring (or the examiner's hand holding the string) from one side to the other through an arc of 180°. Interest in the examiner's face may, however, interfere with ring following at this very social age. When the ring is held suspended over his chest, his *arms activate* (3). The ring is placed in his hand and he accepts it, *regards it* as he *holds* it, brings it to his *mouth*, and approaches it with the *free hand* (4). His behavior with the RATTLE (5) is similar though he is more likely to drop it.

The examiner then rings a hand BELL sharply a few inches from the ear. The baby attends the sound with abated activity. He may blink, or frown, or smile (facial response).

The examiner then confronts the baby preparatory to the PULLED-TO-SITTING test. The 16-week-old baby initiates the social approach, *smiling* almost *automatically* in response to the examiner's face. The examiner takes the baby's hands and pulls him to the sitting position. The *head lags only slightly*, and he *vocalizes or smiles* pleasurably on attaining the supported SITTING position. He holds his head erect but *set forward* (6), and it is steady. His back shows only a *lumbar curvature* (6).

Placed in a supporting chair (or held seated) confronting the TEST TABLE, he is predominantly interested in the examiner, but he fingers the table top surface and finally *regards his own hands and the table top* (7).

When a single CUBE is presented he fol-

lows the examiner's withdrawing hand but then spies the cube, regards it *recurrently*, and his *regard shifts from hand to cube* (8). The *arms activate* (8) and he may *contact the cube.*

He follows the examiner's withdrawing hand again when the PELLET is presented, regards his own hands and finally gives the pellet *delayed, recurrent regard* (9).

He gives the CUP immediate and prolonged attention, the *arms activate* (10), and he contacts the cup. He *looks from hand to cup.*

The BELL also evokes prompt and prolonged regard and activation of the arms.

The test table is then removed and the infant held in the STANDING position, supported around the chest under the axillae. He sustains a small fraction of his weight briefly, extending the legs recurrently and *rising to his toes.* He tends to flex his toes, and he may lift his foot.

In PRONE orientation, when held suspended above the table he holds the head in good alignment with the trunk. As he is placed down on the table, he maintains the midposition of the head, holding it *sustainedly lifted in Zone III* (11). The legs are *extended or semi-extended* (11). He props himself on his forearms; because *one arm is flexed,* the *other more extended* and the head position high, his prone equilibrium is unstable and he shows a *tendency to roll* (12) to the side, though he seldom actually rolls. A lure (toy) may be used to induce head lifting.

In his interest in the test toys he may *strain, breathe fast,* purse his lips and show other evidences of excitement. He is REPORTED to coo and to *laugh aloud,* to "recognize" his *bottle,* to play with his *hands, bringing them together with mutual fingering,* and to *pull his dress over his face* in play. He sits *propped with pillows for ten to fifteen minutes.*

Normative Behavior characteristic of the KEY AGE: 16 WEEKS and adjacent age levels is codified by the *Developmental Schedules* shown on the adjoining page.

DEVELOPMENTAL SCHEDULES

KEY AGE: 16 Weeks

12 Weeks	KEY AGE: 16 Weeks	20 Weeks
Motor	*Motor*	*Motor*
Su: head predom. half side (t-n-r)(*16w) Su: midpos. head & symm. pos. seen Sit: head set forward, bobs (*16w) St: small fraction weight briefly St: lifts foot (*24w) Pr: head Zone II sustained Pr: on forearms (*20w) Pr: hips low (legs flexed) (*40w) Su: hands open or loosely closed Ra: holds actively Cup: contacts	Su: midposition head predominates Su: symm. postures predominate Su: hands engage (*24w) Sit: head steady, set forward (*20w) Pr: head Zone III, sustained Pr: legs extended or semi-extended (*40w) Pr: verge of rolling (*20w) D. Ring: retains Su: fingers, scratches, clutches (*24w)	P. Sit: no head lag Sit: head erect, steady Pr: arms extended Pr or TT: scratches TT or platform (*28w) Cube: precarious grasp (*24w)
Adaptive	*Adaptive*	*Adaptive*
D. Ring: prompt midline regard D. Ring: follows 180° Ra: glances at, in hand Cube, Cup: regards, more than momentarily	D. Ring, Ra: regards immediately D. Ring, Ra, Cube, Cup: arms activate (*24w) D. Ring, Ra: regards in hand D. Ring: to mouth D. Ring: free hand to midline (*28w) TT: looks down at TT or hands Cube, Cup: looks from hand to object (*20w) Pellet: regards	Ra, Bell: 2 hand approach (*28w) Ra, D. Ring: grasps near hand only (*24w) Ra: visual pursuit lost Ra Cube: holds 1st regards 2nd M. Cubes: grasps 1 on contact (*24w)
Language	*Language*	*Language*
Vo: coos (*36w) Vo: chuckles So: vocal-social response	Express: excites, breathes heavily (*32w) Vo: laughs aloud	Vo: squeals (*36w)
Personal-Social	*Personal-Social*	*Personal-Social*
So: vocal-social response Su: predom. regards Ex. Play: hand regard (*24w) Play: pulls at dress (*24w)	So: spontaneous social smile So: vocalizes or smiles, pulled to sit (*24w) Feeding: anticipates on sight food Play: sits propped 10-15 min. (*40w) Play: hand play, mutual fingering (*24w) Play: pulls dress over face (*24w)	So: smiles mirror image Feeding. pats bottle (*36w)

SIXTEEN WEEKS: Growth Trends

Sixteen weeks marks a turning point. The infant is graduating from the protected confines of the bassinet. In the next three months he will make amazing progress. He will advance from propped sitting to the first stages of unpropped sitting. He will prehend and manipulate. He will vocalize with versatility. He will show increasing capacity to amuse himself in exploitive play. The developmental transitions from 16 weeks to 28 weeks are not sudden, but they are unremitting.

Sixteen weeks ushers in a period of rapid cortical organization which brings about a steady transformation of sensori-motor patterns, particularly in the co-ordination of eyes and hands. The visual-motor system has already made enormous gains. The 16-week infant, indeed, can not only catch sight of his own hand; he can fasten his eyes on the examiner's hand; and he can even fixate recurrently upon an 8 mm. pellet which the examiner has placed on a table within the infant's ocular reach.

The baby can reach with his eyes before he can reach with his hand—which is in accordance with the cephalo-caudal trend of neuro-motor development. The pellet is so small that his regard for it is sketchy and comes with delay. But when the larger cube is placed upon the table, his roving eyes immediately settle, his arms activate, and he contacts the cube. This is prehension in the making.

The one-inch cube has a stimulus power which lies midway between cup and pellet. The result is a developmental gradient which has some diagnostic value: 12 WEEKS contacts a cup; 16 WEEKS contacts a cube; 28 WEEKS contacts a pellet. We may look upon the crude arm activity of 16 weeks as an embryological *anlage* from which more refined approach, grasp and manipulation will ultimately take shape. Looking, reaching, contacting, grasping, manipulation and exploitation thus constitute a developmental sequence. One emerges from the other.

The 16-week infant is pretty much limited to contacting, but it is the motor equipment rather than his dynamic drive which is crude. The clutching and fisting so prominent in the neonatal period have not yet altogether disappeared; his hands are not completely open.

They still cling near the chest. He is under the limitations of symmetry imposed at this age by the midline position of his head. Accordingly he brings his hands together in a prayerful attitude and engages in playful mutual fingering. This fingering has a simple exploitive significance. The primitive clutch intrudes; dress and blanket are caught in the fingers and pulled up over the face. The mother may impute intention to this feat; the examiner will appreciate its neuro-motor implications.

Incidentally, the symmetric on-the-chest posture of the arms brings the hands near the mouth. And the mouth, being a sort of prehensory organ in its own rights, often sucks the fingers or fist. This kind of sucking has a simple sensori-motor (and developmental) significance.

The 16-week infant is transcending the asymmetry of the t-n-r which threatened to make him one-sided. He is bidextrous, and tends to move his arms in unison. For the next 8 weeks he goes through a symmetric two-sided phase. Even at 24 weeks of age he makes a bilateral, two-handed prehensory approach upon a toy. By 28 weeks he is transcending this phase of symmetry and makes a one-handed approach.

At 16 weeks there is a developmental premium on the organization of eye and head postures, and eye and hand postures. The shifting of regard from hand to cube, for example, is more than a conflict between two objects in view; it is the first step toward bringing the hand into relation with the cube. Later the eyes direct the hand to the cube: there is immediate approach and grasp on sight.

Meanwhile the rapid development of head, eye and hand co-ordination does not exclude development of the axial musculature. The 16-week trunk, to be sure, still slumps even with the support of the body-band of the examining chair; but in the supported sitting position the back is no longer uniformly rounded; the curvature is confined to the lumbar region; the cervical region, being near the head, is by this time more fully organized. At 24 weeks the trunk is "stronger" which means that the axial musculature has attained more complete functional relationship with the central nervous system and is therefore more capable of sustained tonus. Accordingly the 24-week baby can roll from supine to prone, and he can sit for a brief

moment, leaning forward. He is advancing from a supine to a sedentary status.

The neuro-motor organization of larynx and thorax has undergone and will undergo similar differentiations. At 16 weeks his expressional behavior is still comparatively generalized. He expresses interest by straining his whole body forward, and by a heavy, rapid excited form of breathing. He coos with contentment, and laughs aloud with pleasure. Later as his vocal apparatus becomes more flexible and his breath bellows more sensitive to control, he utters squeals, grunts, and growls. Many neuro-motor differentiations must be achieved before he reaches the threshold of that highly socialized form of communication known as speech. His present vocal behavior is pointing toward that threshold.

The second quarter of the first year therefore proves to be almost dramatic in the scope and swiftness of its behavior transformations. There is something prophetic in the way in which the 16-week infant relishes the sitting position. His eyes widen, pulse strengthens, breathing quickens and he smiles when he is translated from the supine horizontal to the seated perpendicular. This is more than an athletic satisfaction in his newly acquired head balance. It is more than a postural triumph. It is a widening of horizon, a new social orientation.

28 WEEKS
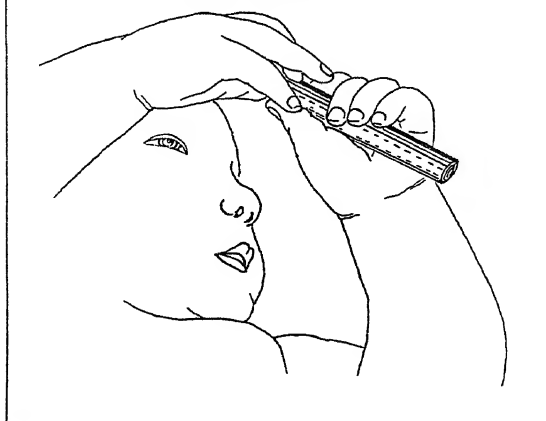
1. Holds cubes more than momentarily

2. Transfers cube

3. Rakes at pellet

4. Bangs bell

5. Transfers and mouths bell

6. Lifts head
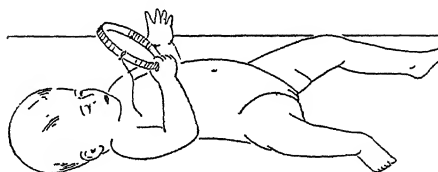
7. Transfers ring
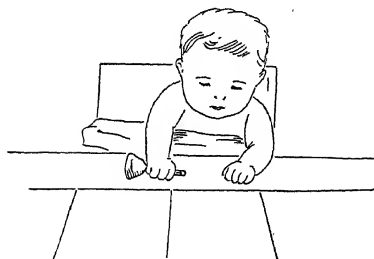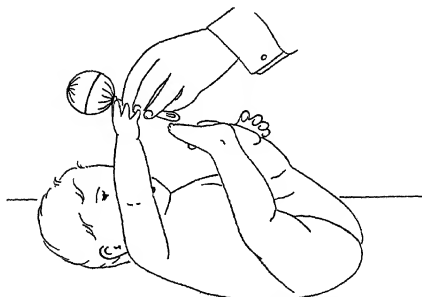
8. Reaches with one hand

9. Sits momentarily leaning on hands
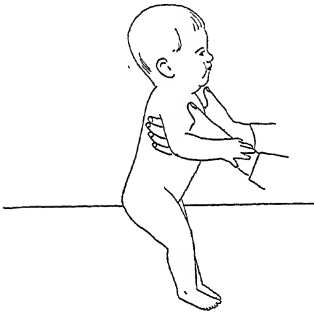
0. Sustains large fraction of weight; bounces
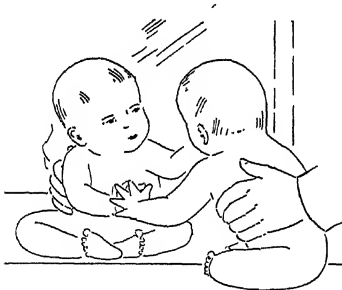
11. Regards image; pats glass

12. Feet to mouth

The 28-week-old infant sits with support, his trunk erect and head steady. After a brief period with an introductory toy, it is removed and the examiner presents the FIRST of three CUBES. The baby seizes it *immediately* with a *radial palmar* grasp and carries it to his mouth. He *retains* it as the SECOND CUBE is presented. He does not grasp the second cube but he holds *2 cubes more than momentarily* (1) when they are placed in his hands. As the THIRD CUBE is presented, he drops a cube. He does not grasp the third cube but mouths, *transfers* (2), drops and resecures the cube in hand.

He follows the screen as it is removed from the MASSED CUBES, then approaches the mass with both hands, grasping one cube and scattering the others. *Holding one cube he grasps another;* he may pick up 3 in all.

He follows the examiner's hand away as the PELLET is presented; gives delayed, intent regard to the pellet, and *rakes* (3) at it with his fingers, *contacting it.*

He makes an *immediate one-handed* approach on the BELL, taking it by the bowl or junction. He *bangs* (4), mouths and *transfers* (5) the bell, *retaining* it without dropping.

The RING AND STRING are presented, the string obliquely aligned to the right, but within reach. He *reaches toward the ring*, slaps and scratches the table, and finally sees the string; he either *abandons the effort or fusses.*

The test table is removed. He is placed on his back on the platform. His SUPINE posturings are symmetrical, with the legs lifted high in extension or semi-extension. He *lifts the head* (6) as though striving to sit up. He is none too tolerant of the supine position and this and the following three situations may have to be curtailed or omitted.

He grasps, *transfers* (7) and mouths the DANGLING RING, regarding it in hand.

He makes an *immediate one-handed approach* (8) upon the RATTLE, *shakes* it vigorously, regards it and fingers it with the free hand. If it is placed on the platform at his side, he reaches for it unsuccessfully.

When auditory responses are tested by RINGING A BELL opposite first one ear, then the other, he turns his head correctly and promptly.

The examiner now takes his hands and he lifts his head and assists in the PULL-TO-SITTING. In the SITTING position he sits *for*

a *moment, leaning forward, propped* on his hands (9). He also shows some *active balance, sitting erect for a fleeting, unsteady moment.*

Held in the STANDING position, he sustains a *large fraction of weight* (10) on his extended legs as he *bounces* actively.

Placed PRONE, he holds the head well lifted, his weight on his abdomen and hands. He *lifts one arm* toward a lure and he *tries, unsuccessfully, to pivot.*

Seated before a MIRROR, he regards his image, smiles, vocalizes and *pats the glass* (11).

His LANGUAGE includes cooing, squealing, and *combined vowel sounds.* He says *m-m-mum* when he cries.

His mother REPORTS that he discriminates strangers, "talks" to his toys, *takes solids well,* and even *brings his feet to his mouth* (12). He rolls from supine to prone and sits propped about half an hour.

Normative Behavior characteristic of the KEY AGE: 28 WEEKS and adjacent age levels is codified by the *Developmental Schedules* shown on the adjoining page.

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DEVELOPMENTAL SCHEDULES

KEY AGE: 28 Weeks

24 Weeks	28 Weeks	32 Weeks
	Motor	
Su: lifts legs high in ext. Su: rolls to prone P. Sit: lifts head, assists (*40w) Sit: chair: trunk erect (*36w) Cube· grasps, palmarwise (*36w) Ra: retans	Su· lifts head (*40w) Sit: briefly, leans fwd. (on hands) (*32w) Sit: erect momentarily St: large fraction of weight (*36w) St: bounces actively (*32w) Cube radial palmar grasp (*36w) Pellet: rakes (whole hand), contacts(*32w)	Sit: 1 min , erect, unsteady (*36w) St: maintains briefly, hands held (*36w) Pr. pivots (*40w) Pellet: radial raking (*36w) Pellet: unsuccessful inferior scissors (*36w)
	Adaptive	
D· Ring, Ra, Cube, Bell: approaches & grasps Ra· prehen. pursuit dropt Ra Cube· regards 3rd cube immediately Cube, Bell: to mouth (*18m) Cube· rescues dropt cube M. Cubes· holds 1, approaches another	Ra, Bell: 1 hand approach & grasp M. Cubes: holds 1, grasps another Cube: holds 2 more than momentarily Bell: bangs (*40w) Ra: shakes definitely D. Ring, Cube: transfers Bell: transfers adeptly Bell: retains	Cube: grasps 2nd cube Cube· retains 2 as 3rd presented Cube: holds 2 prolongedly Cup-cu: holds cube, regards cup Ring-str: secures ring
	Language	
Bell-r: turns head to bell Vo: grunts, growls (*36w) Vo: spontan vocal-social (incl. toys)	Vo: m-m-m (crying) (*40w) Vo: polysyllabic vowel sounds (*36w)	Vo· single syllable as da, ba, ka
	Personal-Social	
So: discriminates strangers Play: grasps foot (supine) (*36w) Play: sits propped 30 min. (*40w) Mirror: smiles and vocalizes	Feeding: takes solids well Play: with feet to mouth (supine) (*36w) Mirror: reaches, pats image Ring-str: fusses or abandons effort (*32w)	Play: bites, chews toys (*18m) Play: reaches persistently for toys out of reach (*40w) Ring-str: persistent

TWENTY-EIGHT WEEKS: Growth Trends

One of the major goals of infant development is the upright pos-
ture. The 28-week-old infant is chronologically and developmen-
tally at a half-way station on the road to this goal. He is just begin-
ning to sit alone, erecting his trunk for a brief moment. After he
has doubled his age, at 56 weeks, he stands alone.

When the 28-week infant is placed supine, he manifests this urge
to sit by lifting his head from the platform. This is a deeply ingrained
propensity. Placed in a standing position, steadied by the trunk, his
legs sustain a large fraction of weight. His arm control is, however,
far in advance of his leg control. When securely placed in the ex-
amining chair he delights in exercising his new powers of manipula-
tion. At 16 weeks he sat in rather stiff bilateral symmetry. Now his
trunk is more supple, and he can make an eager unilateral forward
thrust to reach an object like the hand bell. He is more mobile at
shoulder, elbow and wrist joints. He is transcending the earlier phase
of bilateral symmetry. Not only does he make a one-handed ap-
proach upon the bell, he shifts the bell from one hand to the other
with startling adeptness.

This shuttle-like transfer has both symmetric and asymmetric fea-
tures. Nature is weaving a very complicated neuro-motor fabric,
laying down the warp and woof for that specialized functional
asymmetry which goes by the everyday name of right-handedness or
left-handedness. The 16-week infant is bidextrous; the 40-week in-
fant will be unidextrous; the 28-week infant is bi-uni-dextrous.
Hence his propensity for transfer and retransfer and retransfer again.
It is one of his most typical patterns.

This same alternating type of action in the 32-week infant pro-
duces a circular translocation when he is placed on his stomach.
Being geared to alternating movements, he flexes and extends his
arms in successional turns, causing his trunk to pivot. (At a later age
when his arms are again for a time geared to bilateral movements
in the prone position, he pushes himself backward or drags him-
self forward.) At present his legs are not sufficiently developed
for creeping.

The 28-week infant is therefore far in advance of the 16-week in-

fant in patterns of prehension and his eyes continue to be more skillful than his fingers. Thanks to his ocular adjustments he can pick up a string perceptually; but he is very inept at plucking it with his fingers. Likewise he can give consistent (ocular) regard to a pellet; but he places his hand rather crudely over it and usually fails to secure it. Prompt precise prehension of the pellet comes at about 40 weeks, due to the specialization of the radial digits, thumb and forefinger. This too is a sort of functional asymmetry, based on developmental individuation. Interestingly enough, this more advanced asymmetry is already foreshadowed at 28 weeks. Even though the 28-week infant seizes the cube with a hand grasp rather than a finger grasp, he appropriates with the *radial* side of the hand. This *radial* palmar grasp foretells thumb opposition. As so often happens, a present behavior pattern is charged with implications for the future. Only rarely does a baby's behavior hark back to the past.

Although eyes are still in the lead, eyes and hands function in close interaction, each reinforcing and guiding the other. Whereas the 16-week-old infant is given to inspection of surroundings, the 28-week-old infant inspects objects. And if the object is within reach it is usually in his busy hands. Head became versatile in the previous trimester; hands became versatile in this one. As soon as he sees a cube he grasps it, senses surface and edges as he clutches it, brings it to his mouth, where he feels its qualities anew, withdraws it, looks at it on withdrawal, rotates it while he looks, looks while he rotates it, restores it to his mouth, withdraws it again for inspection, restores it again for mouthing, transfers it to the other hand, bangs it, contacts it with the free hand, retransfers, mouths it again, drops it, resecures it, mouths it yet again, repeating the cycle with variations— all in the time it takes to read this sentence.

The perceptual-manipulatory behavior of the 28-week-old infant is highly active. It is not passive reception. It is dynamic adaptivity, fused with exploitativeness. If you wish, it is intelligence.

His vocal behavior is filled with forward reference. It serves little immediate sociological purpose, but it does serve a neurological one. For in his diversified spontaneous vocalizations he is producing vowels, consonants, and even syllables and diphthongs,

which in due time will eventuate in articulate communication. Even now an *m-m-m* utterance emerges when he cries.

Although he is verbally inarticulate, he is socially pretty wise. He knows what is going on around the house. He expresses eagerness and impatience as he sees his mother preparing food for him. He shows familiarity and anticipation in the routines of the household. He recognizes strangers and tolerates them if they do not disappoint his expectancies. He is self-contained and will play for considerable periods by himself. Long ago he abandoned the hand play characteristic of 16 weeks. He plays with his feet instead, which represents at least a cephalo-caudad advance, and is part of his process of self-discovery. He is self-contained, content with his own devices. His very self-sufficiency makes him seem a more or less finished product. But in time he will make a clearer distinction between himself as a person and other persons. He is, in fact, laying the foundations for this more socialized perceptiveness.

40 WEEKS
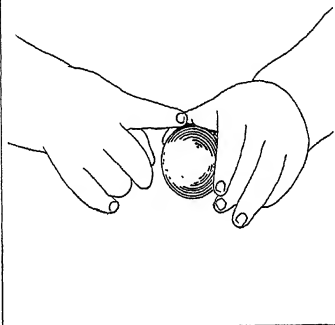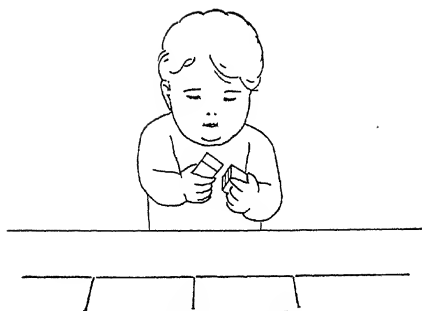
1. Matches two cubes
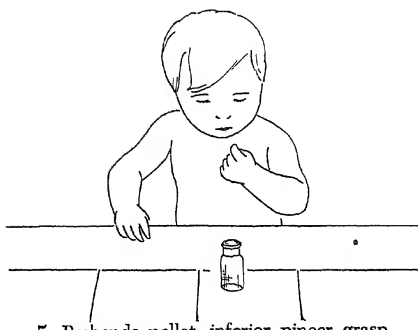
5. Prehends pellet, inferior pincer grasp
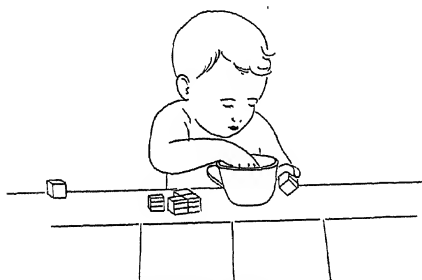
2. Fingers cube in cup
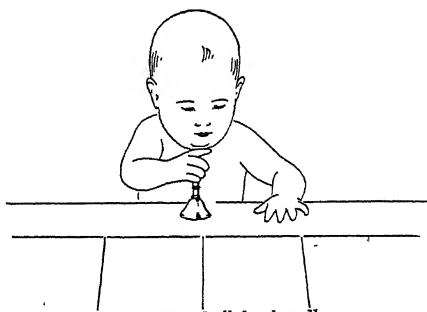
6. Grasps bell by handle
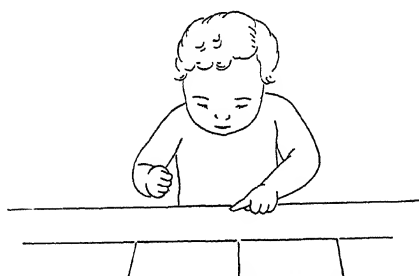
3. Approaches with index finger
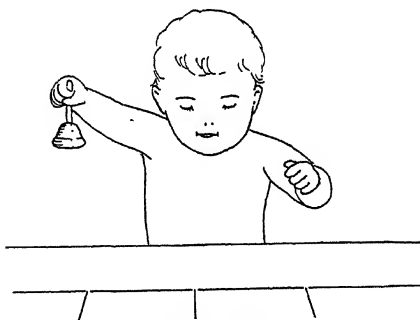
7. Waves bell
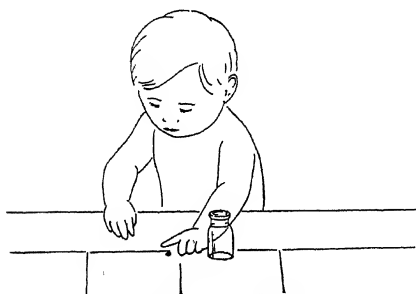
4. Approaches pellet first
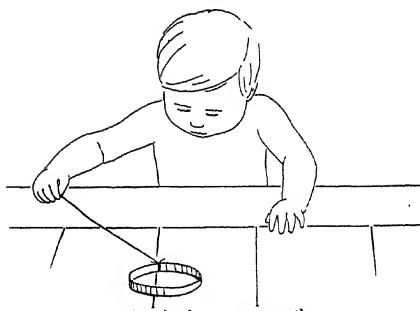
8. Plucks string easily

52

9. Sits with good control
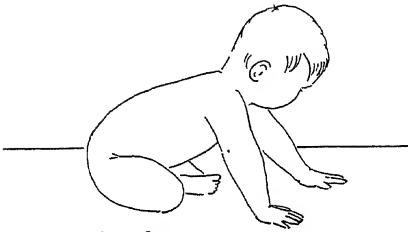
10. Goes from sitting to prone
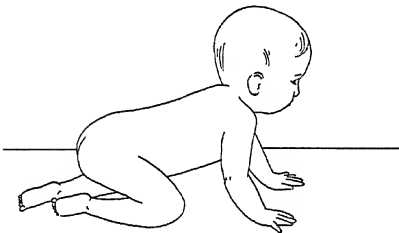
11. Creeps
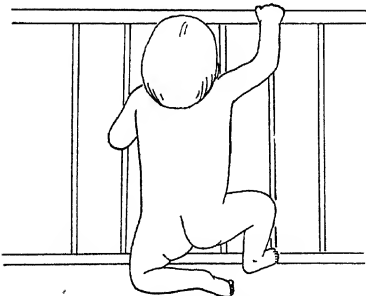
12. Pulls to feet at rail

The 40-week infant sits with good postural control and without support before the test table.

He gives immediate heed to the FIRST CUBE and seizes it with a radial digital grasp. He transfers the cube and retains it as the SECOND CUBE is presented. He seizes this in a similar manner and holds the 2 cubes as the THIRD CUBE is presented. He approaches the third cube with a cube in hand, hitting or pushing the cube on the table, and he brings 2 cubes into apposition as though matching (1) them.

In the MASSED CUBE situation he reaches for the screen, but then immediately approaches the mass with *one hand* and grasps a single cube, *selecting the top cube or a corner cube.* Holding one cube he grasps another, and brings the cubes into combination. He *releases* a cube and exploits 3 or more in all with method and *control.*

The examiner now places the CUP at the left side of the cluster of cubes. The baby grasps the cup by the rim, later he takes a cube and brings it against the outside of the cup. The examiner then drops a cube into the cup, and the baby reaches in and *fingers the cube in the cup* (2).

He approaches the PELLET with extended *index finger* (3) and prehends it promptly with an *inferior pincer grasp* (5).

Securing the baby's attention to the maneuver, the examiner drops the PELLET INTO the BOTTLE and places the bottle on the test table. The baby watches the dropping of the pellet, but his regard for the pellet in the bottle is questionable. He grasps the bottle and mouths it. If the *pellet falls out* he *regards* it on the test table but continues to exploit the bottle.

The examiner then presents the PELLET BESIDE THE BOTTLE, the pellet on the right. The baby *reaches for the pellet first* (4), *grasps the pellet* (5), drops it and then exploits the bottle.

He approaches the BELL and *seizes it by the handle* (6). He mouths the bell, transfers it, and spontaneously *waves and shakes it* (7).

The RING WITH STRING in oblique alignment is placed on the test table. He reaches directly toward the ring first, then *plucks the string easily* (8), pulls in the ring, transfers the ring and manipulates the string.

The FORMBOARD is placed with the round hole at the baby's right, and the baby is offered the round block. He pulls at the

formboard (the examiner holds it firm), accepts the round block, transfers and releases it. The examiner inserts the block in the round hole, and the baby pulls and pries at it and removes it with considerable difficulty. He again transfers and releases the block.

The test table is now removed and the baby is offered the BALL. He mouths the ball and releases it but cannot be induced to respond to the examiner's demonstrations and invitations to roll or toss the ball back and forth in cooperative ball play.

He is then confronted by a MIRROR. He regards his image, *leans forward* and smiles and vocalizes as he pats the glass. He is offered the ball which he accepts and retains; he disregards the mirrored ball.

POSTURAL BEHAVIOR is now observed. He has already displayed his ability to *sit with good control* (9). Enticed by a lure, he *goes from the sitting to the prone* position (10). In prone he gets up on his hands and knees and *creeps* (11) forward. Holding a railing he *pulls himself to his feet* (12), stands holding on, and *lowers himself* again. When his *hands are held, he stands supporting his full weight.*

He VOCALIZES *mama* and *dada*, and has *one other "word."* He imitates sounds (cough, click, razz) and responds to "no-no" and his name.

He is REPORTED to hold his bottle and to feed himself a cracker. He *pata-cakes* and waves *bye-bye.*

Normative Behavior characteristic of the KEY AGE: 40 WEEKS and adjacent age levels is codified by the *Developmental Schedules* shown on the adjoining page.

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DEVELOPMENTAL SCHEDULES

KEY AGE: 40 Weeks

36 Weeks	40 Weeks	44 Weeks
	Motor	
Sit: 10 min.+, steady	Sit: indefinitely, steady	St: (at rail) lifts, replaces, foot (*48w)
Sit: leans forward, re-erects	Sit: goes over to prone	Bell: grasps by top of handle
St: holds rail, full weight	St: pulls to feet at rail (*15m)	
Cube: radial digital grasp	Pr: creeps (*15m)	
Pellet: prehends, scissors grasp (*40w)	Cube: crude release (*15m)	
	Pellet: grasps promptly	
	Pellet: inferior pincer grasp (*48w)	
	Ring-str: plucks string easily	
	Adaptive	
Cube: grasps 3rd cube (*40w)	Cube: matches 2 cubes (*15m)	Cup-cu: removes cube from cup
Cube: hits, pushes cube with cube (*15m)	Cup-cu: touches cube in cup	Cup-cu: (Dem) cube into cup without release (*52w)
Cup-cu: cube against cup (*44w)	Pellet: index finger approach	Pellet in bo: points at P thru glass (*18m)
Pellet & bo: approaches bottle first (*40w)	Pellet in bo: regards P if drops out	Bell: regards & pokes clapper
Ring-str: manipulates string	Pellet & bo: approaches P first	Ring-str: approaches string first
	Pellet & bo: grasps P	
	Bell: grasps by handle	
	Bell: spontaneously waves or shakes	
	Language	
Vo: dada (or equivalent)	Vo: dada & mama	
Vo: imitates sounds	Vo: 1 "word"	
Comp: responds to name, no-no	Comp: bye & patacake	
	Personal-Social	
Feeding: holds bottle (*15m)	So: waves bye and patacakes (*...)	So: ext. toy to person, no release (*52w)
Feeding: feeds self cracker		Feeding: drinks from cup (in part)
		Mirror: reaches image ball in hand (*52w)

FORTY WEEKS: Growth Trends

The index finger comes to the fore at 40 weeks. The poking, prying, palpating extended fore-finger is itself an index of an important advance in maturity. In a neuro-motor sense the patterns of behavior have become more refined, more discriminating. Many of the reactions of the 28-week level are massive and crude in comparison. The 28-week infant can barely contact a pellet and he does so with a whole hand raking approach; the 40-week infant prehends promptly with pincer precision. TWENTY-EIGHT WEEKS slaps a string; FORTY WEEKS plucks it easily. Placed on his stomach, TWENTY-EIGHT WEEKS stays put; FORTY WEEKS creeps. FORTY WEEKS sits prolongedly, TWENTY-EIGHT WEEKS precariously. One does not make such a comparison to the discredit of the junior infant. However, the comparison would have grave diagnostic import if it referred to a 40-week-old infant functioning at the 28-week level. For this reason we are always pleased to see the poking pattern come into evidence in the forties of infancy. This pattern testifies that the distal outposts of the neuro-motor system,—finger tip, tongue tip, feet and toes are undergoing their normal maturation.

The 40-week infant pulls himself to his feet at the palings of his pen; a foretoken of upright locomotion even though for the remaining quarter of the year he will utilize the ancient method of quadrupedal progression. His creeping is one of a score of progressive stages which culminate in bipedal walking.

The increased refinements in prehension are correlated with increased discriminativeness in manipulation. They herald, if they do not actually occasion, a heightened interest in small objects. The crumb on the high chair tray, as well as the pellet on the test table, provokes the propensity to poke and to palpate. Out goes the exploratory index finger. Tiny objects may now possess greater stimulus potency than larger ones.

When the examiner places a pellet beside the bottle he sets up two rival stimuli: large vs. small object. At 36 weeks the baby reaches for the bottle first and disregards the pellet; but at 40 weeks he reaches for the pellet first; at 48 weeks he pays almost exclusive attention to the pellet; at 52 weeks he attempts to insert the pellet

in the bottle. This maturity sequence reflects the orderliness and delicacy of the developmental process: (a) first the large object has priority; (b) then the small object gains priority; (c) then combination of small and large object prevails. The year-old baby usually fails in his attempt to drop the pellet into the bottle. This is due to the immaturity of prehensory release rather than a lack of perception for container and contained.

The perception of this relationship of container and content has been long in the making. Note the growth of behavior patterns in the cup (container) and cubes (content) situation. The infant of 28 weeks was scarcely old enough for the test. His responses at least would be virtually undiscriminating. At 32 weeks he gives prior attention to the cubes; but as he holds one of the cubes he gives a well-defined glance at the cup. Developmentally this presages a combination of cup and cube; in fact it is an ocular combining. At 36 weeks it becomes a manual combining for he literally brings the cube against the cup. But this is the limit of his combinative capacity. He will not place the cube into the cup nor alter his behavior even though the examiner plies him with gesture, command and actual demonstration.

This, however, is a temporary, developmental kind of disobedience. For at 40 weeks, the baby thrusts his hand into the cup (after the examiner has placed a cube in it), and he fingers the cube. In another month he will extract it and re-thrust his hand into the cup, retaining clenched hold of the cube. At 12 months he consummates the pattern by voluntarily releasing a single cube in the cup. Further developmental elaborations of this continue into the second year of life and will be recounted later.

All told, 40 weeks is a prophetic period. With his inquisitive index finger the infant is beginning to penetrate into the third dimension. He is beginning to be analytic. He segregates a single detail for attention, and he reacts in a successive and combining way to two details or to two objects. In the presence of more than one object he manifests an awareness of more than one, a dim sense of twoness: of container and contained, of solid and hollow, of top and bottom, of one side and another side.

In vocalization he is becoming articulate. He is socially responsive to demonstration; hence his nursery tricks and other engaging

evidences of educability. At 12 and 15 months one sees how these foretokens of discriminating behavior come to their destined fulfillment.

Forty weeks therefore marks a transition to what is almost an epoch, since there are so many new and distinctive patterns of behavior emerging in the developmental complex. The supine position so acceptable throughout the first quarter of the year is now scarcely tolerated except during sleep. The 40-week-old infant speedily escapes from supineness by rolling or raising himself to a sitting position. His impulse to stand (with support) is irrepressible. He takes a new social interest in the household and even enjoys short expeditions into the outside world. He shows a new interest in words, both as receptor and producer. In prehension, manipulation, and investigativeness he gives many significant tokens of discrimination and elaborative behavior. Not only is he penetrating deeper into the family circle, but he himself is more fully adopted by that circle as a participating member. This is further evidence of important psychological transformations.
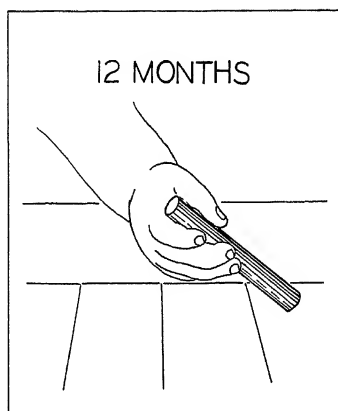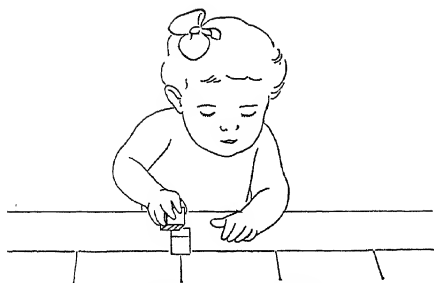
12 MONTHS

1. Attempts tower; it falls
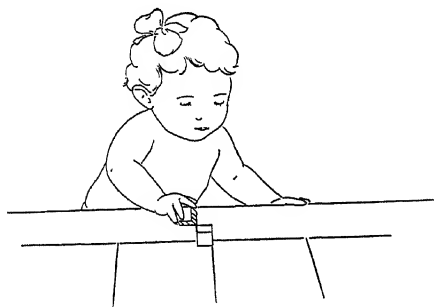
2. Applies cube on cube without release
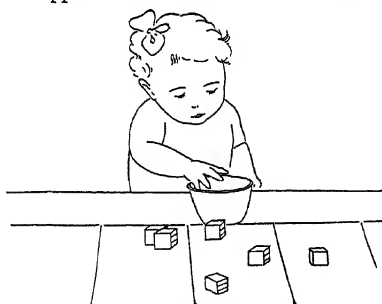
3. Releases one cube into cup

4. Gives toy on request

5. Tries to insert pellet

6. Pellet falls outside bottle
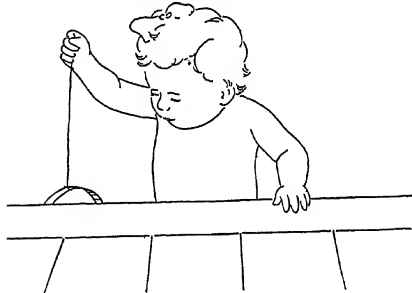
7. Dangles ring by string

8. Looks selectively at round hole

60
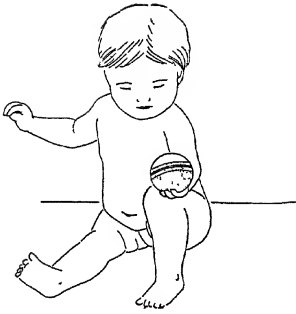
9. Offers ball without release
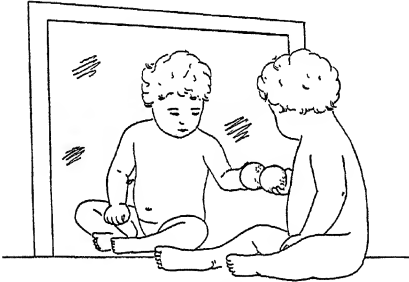
10. Applies ball to glass
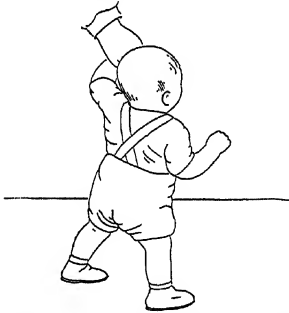
11. Walks when only one hand is held

12. Walks when only one hand is held

The year-old child sits erect and unsupported before the test table and he is quite likely to pivot in the sitting position and carry the introductory toy to the side or to the platform. He may *give the toy* (4) to the examiner on request, or it is tactfully removed as the FIRST, SECOND and THIRD CUBES are presented in succession. He brings the cubes together briefly; or he hits and pushes one cube with another.

The examiner builds a TOWER of 2 cubes and tries by demonstration and gesture to induce the child to do likewise with 2 cubes. The child manipulates the cubes, *takes a cube from the model*, and he *"attempts" a tower but it falls* (1). He may also apply *one cube upon another without release* (2).

In the MASSED CUBES situation he makes a two-handed approach and takes 2 cubes, usually selecting the top cube and a corner cube. He exploits the cubes in a controlled manner, combiningly or in one-by-one sequence. He seizes and releases as many as 4 cubes.

The CUP is then placed to the left of the cluster of CUBES. He takes the cup, and brings a cube into the cup without release. The examiner then drops a cube into the cup by way of demonstration. The child immediately removes this cube, and he *releases a cube into the cup* (3).

His eyes drop as he watches the examiner's placement of the PELLET IN BOTTLE. He takes the bottle, definitely and selectively regards the pellet, pointing at it through the glass; he grasps it if it drops out.

Confronted with the PELLET BESIDE BOTTLE (the pellet on the right) he reaches for the pellet first and picks it up with a neat pincer grasp. The examiner points to the bottle and gently inhibits the child's taking the pellet to the mouth. Under this persuasion, the child brings the pellet over the mouth of the bottle and *tries unsuccessfully to insert the pellet* (5). It falls outside the bottle (6).

In the RING AND STRING situation, the string in the right oblique position within reach, he reaches immediately for the end of the string, plucks it easily and secures the ring. He exploits the ring by transfer, and he *dangles the ring by the string* (7).

He pulls at the FORMBOARD which is presented with the round hole at the right. The examiner holds the board in place and offers the child the round block. He accepts it and then *looks very selectively at the round*

hole (8). The examiner inserts the round block; the child removes it easily, *again looks selectively at the round hole,* and *bangs or releases the block near the round hole.*

The test table is then removed and the BALL is offered. He accepts the ball and on invitation he *extends the ball to the examiner* (9) without release. The examiner then tosses the ball so that it rolls toward the child. After one or two demonstrations, the child *casts the ball* imitatively.

Before the MIRROR he regards his own image with smiling and vocalization, leans forward and pats the glass. He accepts and retains the ball placed in his hands, and *brings the ball against the mirror* (10) applying it to the glass.

His POSTURAL BEHAVIOR includes pivoting in the sitting position, going from the sitting to the creeping position, creeping, pulling to his feet while holding a railing, cruising sideward at the railing, and lowering himself again. He can *walk when only one hand is held* (11), (12).

His LANGUAGE includes *two "words"* in addition to mama and dada. He imitates sounds, responds to his name, "no-no" and *"give it to me."*

He is REPORTED to drink at least some of his milk from a cup, and he feeds himself a cracker. He has several nursery tricks such as patacake and bye-bye; he *co-operates in dressing.*

Normative Behavior characteristic of the KEY AGE: 52 WEEKS and adjacent age levels is codified by the *Developmental Schedules* shown on the adjoining page.

DEVELOPMENTAL SCHEDULES

KEY AGE: 52 Weeks

48 Weeks	52 Weeks	56 Weeks
	Motor	
Sits: pivots St: cruises at rail (*15m) Walks: needs 2 hands held (*52w) Pellet: neat pincer grasp	Walks: needs only 1 hand held (*15m)	St: momentarily alone Cube: grasps 2 in 1 hand
	Adaptive	
Cube: sequential play (*36m) Pellet & bo: takes P only (*56w) Formbd: removes round block easily	Cube: (dem.) tries tower, fails (*15m) Cup-cu: (dem.) releases 1 cube in cup (*56w) Pellet & bo: tries insert, releases, fails (*15m) Ring-str: dangles ring by string Formbd: looks selectively at round hole	Cup-cu: (no dem.) cube into cup Drawing: vigorous imitative scribble Formbd: (dem.) inserts round block (*15m)
	Language	
	Vo: 2 "words" (besides mama, dada) Comp: gives a toy (request & gesture)	Vo: 3–4 words Vo: incipient jargon (*24m) Comp: a few objects by name
	Personal-Social	
Play: toys to side rail (*15m) Play: platform play (*52w)	Mirror: ball to mirror Dressing: co-operates in dressing (*48m)	Ball: releases with slight cast toward Ex. (*18m)

TWELVE MONTHS: Growth Trends

Forty weeks was called a prophetic period. At that age the infant grasps a support and pulls himself to his feet; he plucks a string easily; he reaches his hand into a cup; he does a nursery trick on verbal cue; he shows a growing interest in details. These are not tag-ends of behavior; they are tag-beginnings. They mark the nascent or beginning stages of patterns which come to developmental fulfillment at the age of 15 months.

Consider the advances achieved by the 15-month-old child; he can attain the standing position unaided; he can walk alone; he can put several cubes in and out of a cup; he can place a pellet in a bottle; he can build a tower of 2 cubes; he can talk in jargon; he can communicate by gesture.

The 12-month-old child is just at the brink of all these abilities. Speaking relatively we may say that 40 weeks is nascent and prophetic; 12 months is formative and transitional; 15 months is more finished in behavior organization. The 18-month-old child is still more advanced, but in turn has acquired new prophecies which point to 2 years and beyond. It helps us to understand the behavior equipment of the one-year-old child if we think of him as a 15-month child in the making.

At 15 months the human infant is assuredly a biped. He prefers to walk upright like a man. He has discarded creeping, an ancient method of progression which the 12-month-old still elects. Nevertheless, we cannot regard quadrupedal locomotion as an atavism. It is developmentally transforming into bipedal locomotion. Accordingly the creeping of the 12- and 13-month-old infant tends to become plantigrade; the legs extend at the knees, and the soles of the feet like the palms of the hands are then planted on the ground. This all-fours locomotion proves to be a final step in the assumption of the erect posture. Having planted both soles on the ground he soon rises to his feet. When feet become the fulcrum, the hands are emancipated.

In prehension, however, the 12-month-old infant displays an interesting mixture of maturity and immaturity. He can grasp a pellet or a string with almost adult precision and facility. But having

grasped, he is still a mere baby in his ability to release his grasp. Sometimes he clings to an object with almost neonatal tenacity as though he could not summon voluntary inhibition. This is particularly true in the case of small objects. So we find that not until the age of 15 months can he release well enough to drop the pellet into the bottle even though at 12 months he manages to release a cube into the cup. His repeated picking up and expulsive dropping of individual cubes in his exploitive play is an exercise of his new-found (i.e., new-grown) power of release. His tireless and apparently irresponsible casting of objects at 15 months is a vigorous expression of the same but more abundant power. His ability at 18 months to put as many as 10 cubes into a cup in an orderly manner, with little or no prompting, reflects the cultivation which comes with maturity.

Perception of geometric form is incipient at 12 months. The infant at that age looks selectively at the round hole in the formboard. At 13 months he inserts the round block on demonstration. At 15 months he inserts it adaptively even after the examiner has reversed the position of the hole by rotating the board. The deliberate dangling of the ring by its attached string also suggests a dawning sense of form and of spatial relationships at the age of one year. Of similar import is the incipient, though usually unsuccessful, effort to build a tower.

Perception of number likewise is incipient at 12 months. The sequential one-by-one manipulation of individual cubes is more than fortuitous manipulation. It is a rudimentary kind of seriation, the genetic antecedent and the operational basis of counting.

The yearling is increasingly perceptive of his social as well as his physical environment. Socialized perceptiveness leads to imitation. He is responsive to demonstration; he looks intently at facial expressions; he responds to music and to primitive rhythm play; he repeats performances laughed at. He has long been capable of fear, anger, affection, jealousy, anxiety, sympathy and these traits are now more clearly manifested. By such tokens he reveals the complexity and also the individuality of his personal-social behavior.

At 15 months much of his behavior already reflects the impress of the social group. His action patterns have an outward, non-isolation-

ist reference. He shows and offers toys to others; he says "ta-ta" on receipt of goods; he helps to turn the pages of a book and begins to recognize pictures; he uses jargon; he pulls, hauls, lugs, and transports, for his hands are now freed from the menial work of locomotion.

18 MONTHS
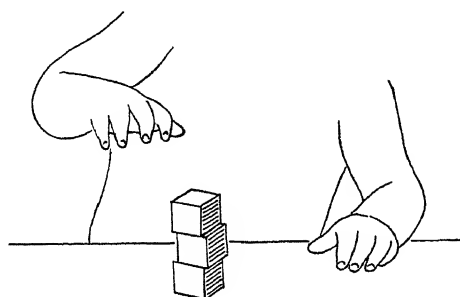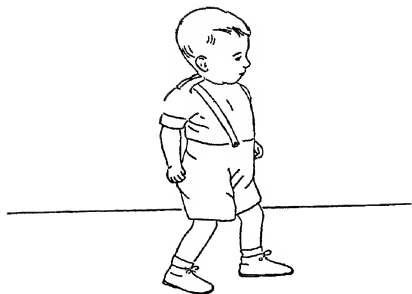
1. Walks alone; seldom falls
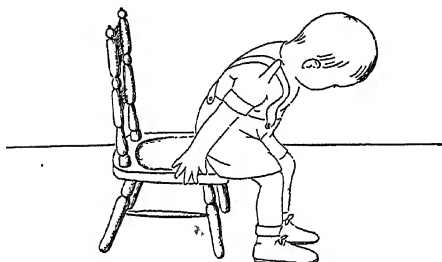
2. Seats self in small chair

3. Turns pages two or three at a time

4. Builds tower of three

5. Fills cup with cubes

6. Dumps pellet from bottle
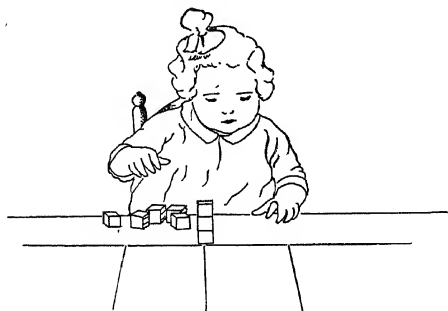
7. Imitates stroke

8. Identifies one picture
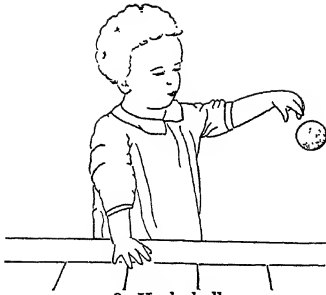
9. Hurls ball
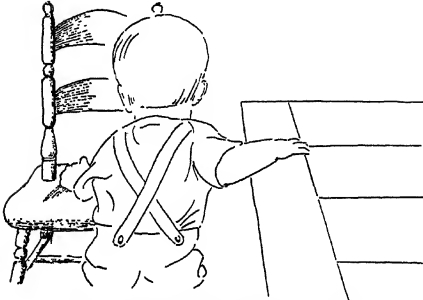
10. On command puts ball on chair

11. Walks into ball
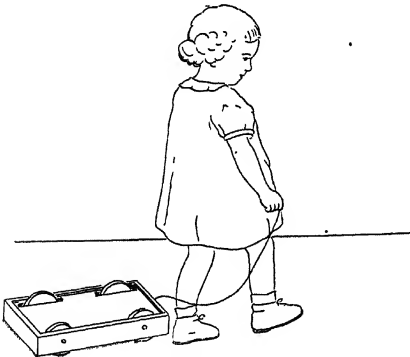
12. Pulls toy

The 18-month child can *walk alone* (1) and he *seldom falls*. He *seats himself* (2) with some care in a small chair before the test table. The mother sits nearby and actively assists in his initial adjustment.

The PICTURE BOOK is on the table, and the examiner starts to turn the pages and comment on the pictures. The child *looks selectively* at the pictures and *turns the pages 2-3 at a time* (3).

The MASSED CUBES are then presented and when he has begun to manipulate them, a tower of 2-3 cubes is demonstrated, and requested. The child responsively builds a *tower of 3-4 cubes* (4), the tower falling with the fourth or fifth cube.

The CUP is then placed at the left of the cluster of cubes. Spontaneously, or on request, the child begins to insert the cubes into the cup. He is urged, if necessary, to continue, and he places *10 cubes in the cup* (5), filling the cup.

The PELLET AND BOTTLE are now presented, the pellet on the right. The child spontaneously (or on request) inserts the pellet. When asked to get it out, he pokes into the neck of the bottle, shakes the bottle, and finally *dumps the pellet out* (6) of the bottle.

The DRAWING situation comes next. A piece of blank paper is placed on the table, and a crayon placed on it in a central position. The child *scribbles spontaneously*, and after a decisive vertical stroke has been demonstrated, he makes an *imitative stroke* (7) without discrimination of direction.

The FORMBOARD is presented with the 3 blocks on the table, each one in front of its appropriate hole. He *piles the 3 blocks* on each other and may finally *insert one* (the round block). He does not adapt to rotation of the board but continues to pile and manipulate the blocks.

On presenting the PICTURE CARDS the examiner points to the dog and asks, "What's this?" (Likewise for the shoe, cup, clock and other objects.) If the child does not respond, the examiner says, "Show me the dog" (etc.). The child *names or points* to one picture (8) correctly. He may turn the card over and hand it back.

The PERFORMANCE BOX is then presented and the child is given the small red rod and encouraged to insert it in the middle hole. After one or two successful trials, he is offered the square block in its place. He brings it *flat against the box*, and even after demonstration is unable to adapt the square block to the oblong hole.

He is now shown a few of the TEST OBJECTS (pencil, shoe, penny, key, ball) in rapid succession and asked to name them. He *names the ball* and is permitted to take it.

For BALL play the test table is moved slightly from position, and the child thus given free access to the room. On request he *hurls the ball* (9) propulsively to the examiner and *carries out two* of the following DIRECTIONS: Put it on the chair (10). . . . Put it on the table. . . . Give it to mother. . . . Give it to me.

He releases the BALL in the PERFORMANCE BOX, *reaches into* the box but is unable to solve the problem and finally *abandons* the effort.

The LARGE BALL is placed on the floor and a kick of the ball is demonstrated and requested. The child responds by *walking into the ball* (11) without giving it a true kick.

He is REPORTED to *hasten his walking steps* but he *runs stiffly*. He *walks upstairs when one hand is held*; he *climbs into an adult chair*.

LANGUAGE includes jargon and as many as *10 single words*, but he usually indicates his wants by pointing and vocalizing.

He has abandoned his bottle; he FEEDS *himself part* of his meals, not without spilling. He *hands the empty dish* to his mother, with a sense of fait accompli.

His TOILET *behavior is regularized during the day time* but not at night by parental vigilance. He co-operates in dressing and has some success in taking off his clothes.

In his PLAY he *carries a doll* or teddy bear and hugs it; he walks about *pulling a toy* (12).

Normative Behavior characteristic of the KEY AGE: 18 MONTHS and adjacent age levels is codified by the *Developmental Schedules*·shown on the adjoining page.

DEVELOPMENTAL SCHEDULES

KEY AGE: 18 Months

15 Months	KEY AGE: 18 Months	21 Months
Motor	*Motor*	
Walks: few steps, starts, stops	Walks: seldom falls	Walks: squats in play (*....)
Walks: falls by collapse (*18m)	Walks: fast, runs stiffly (*24m)	Stairs: walks down, 1 hand held (*24m)
Walks: creeping discarded	Stairs: walks up, 1 hand held (*21m)	Stairs: walks up, holds rail (*24m)
Stairs: creeps up (*18m)	Small chair: seats self	Large ball: (dem) kicks (*24m)
M. Cubes: tower of 2	Adult chair: climbs into (*....)	M. Cubes: tower of 5–6
Pellets: (no dem.) places in bottle	Ball: hurls (*48m)	
Book: helps turn pages (*18m)	Large ball: walks into (*21m)	
	Book: turns pages, 2–3 at once (*24m)	
Adaptive	*Adaptive*	
M. Cubes: tower of 2	M. Cubes: tower of 3–4	M. Cubes: tower of 5–6
Cup-cu: 6 in & out cup (*18m)	Cup-cu: 10 into cup	M. Cubes: imitates pushing train (*24m)
Drawing: incip. imitation stroke (*18m)	Pellet & bo: dumps responsively	Formbd: places 2–3 blocks
Formbd: (no dem.) places round block	Drawing: scribbles spontan. (*36m)	Perf. box: inserts corner of sq. (*24m)
Formbd: adapts round block promptly	Drawing: makes stroke imitatively	Perf. box: retrieves ball
	Formbd: piles 3 blocks (*24m)	
Language	*Language*	
Vo: 4–5 words includ. names	Book: looks selectively	Vo: 20 words
Vo: uses jargon (*24m)	Vo: 10 words includ. names	Speech: combines 2–3 words spontan. (*24m)
Book: pats pictures (*8m)	Picture cd: names or points 1	Ball: 3 directions
	Test obj: names ball	
	Ball: 2 directions	
Personal-Social	*Personal-Social*	
Feeding: bottle discarded	Feeding; hands empty dish (*....)	Feeding; handles cup well
Feeding; inhib. grasp of dish	Feeding; feeds self in part, spills (*36m)	Commun: asks for food, toilet, drink
Toilet: partial regulation (*24m)	Toilet: regulated daytime (*24m)	Commun: echoes 2 or more last words (*24m)
Toilet: bowel control	Play: pulls a toy (*30m)	Commun: pulls person to show (*24m)
Toilet: indicates wet pants (*18m)	Play: carries or hugs doll (*24m)	
Commun: says "ta-ta" or equiv.		
Commun: points, voc. wants (*21m)		
Play: shows or offers toy (*21m)		
Play: casts obj, in play or refus. (*18m)		

EIGHTEEN MONTHS: Growth Trends

The period between one and two years is extraordinarily rich from the standpoint of developmental transformations. The 18-month infant is in the very middle of this period of swift and not always easy advance. He is ceasing to be a mere baby but he is still very dependent on caretaker and on circumstances. It is easy to expect too much of him and to forget that he is in a critical phase of transition, —a phase the race traversed only by painful and protracted stages. It took the race a long time to achieve upright posture, articulate words, and cultural conventions, including bladder and bowel control, to say nothing of buttons, spoons, and handkerchiefs.

The 1-year-old by reason of his immaturity, locomotor and otherwise, is relatively protected from excessive impacts of culture. But the 18-month infant is on the loose, colliding with new problems at every turn. Life is not quite so easy for him.

Moreover the relationships between the autonomic, sensori-motor and inhibitory areas of his nervous system are in a peculiarly complex state of formativeness. Larynx, legs, hands, feet and sphincters are concurrently coming under cortical control. The infant-child therefore has an extraordinary diversity of behavior patterns to coordinate and to consolidate. Because this neuro-motor organization is so inclusive and intricate, he is generally limited to brief, diversified shifts of attention. At 2 years he will listen better, look longer; he will live less from moment to moment. At 3 years he is still more settled owing to his widened attention span.

Nevertheless, the 18 month behavior picture has more in common with 2 years than with 1 year. The 18-month child assuredly is a biped, for quadrupedal locomotion is usually abandoned by 15 months. He walks without falling and is even beginning to run, but his walk wobbles and his running gait is stiff and flat. At 2 years ankles and knees are more flexible, not so much on account of articular changes as on account of a more advanced functional organization of the controlling neurones.

Because both his postural control and experience are immature, even simple acts like seating himself in a chair have their difficulties. He lacks the visual pre-perception and hence the judgment to

perform this feat neatly. He shows the same developmental ineptitude in his manipulation of a spoon or a cup, tilting each excessively at the mouth. At 2 years he will hold the spoon with a more supinate grasp, on a more even keel. This gain in skill cannot be altogether ascribed to learning through experience; it grows out of underlying postural changes determined by the maturation of the nervous system.

Although he has scanty pre-perceptions and a meager memory span, his immediate perceptions are decisive. He hands you an object with a *now-that's-done* air. He performs a nursery trick with a sense of completion or termination. This trait is a key to his mentality. It accounts for the sketchy, punctuated conclusiveness of his reactions. It makes him appear mercurial, for his actions lack a certain margin of tentativeness which becomes more apparent at 2 and 3 years.

This positivism combined with a strong locomotor drive causes him to seem over-assertive, non-conforming, and even negative. Such behavior should be regarded as a natural, indeed necessary, condition of development. At 2 years he will seem less self-engrossed. He will refer and defer more to his mother, but even then he will show certain so-called "resistances" which are entirely normal symptoms of immaturity.

The 18-month-old is immersed in himself, because he lacks the detachment to individualize another person. Even though he may look at a newcomer with concentrated interest, he has only a dim sense of the status of others as separate from himself. At 2 years, likewise, he is still very self-centered, self-engrossed, occupied with things and activities rather than with persons as persons. At 3 years, however, he is establishing a working distinction between his own personal self and other personal selves.

The social utilization of words develops by similar stages. The language of the 18-month-old is likely to be in a jargon phase just about as well defined as his perception of persons and events. There is in fact a close relationship between intellectual perception and command of words. Typically he shows mastery of only a half-dozen words. He can say "eat" and he can understand a very simple sentence if the words of the sentence release a familiar motor experience, such as Go-and-get-your-hat.

But he will steadily become more articulate. He will have a considerable vocabulary at 2 or 3 years; and at 2 years he will even begin to combine words. Becoming articulate depends upon maturity. It signifies that diffuseness is giving way to discreteness; projection is supplementing self-absorption; identity *of* the mother is displacing identity *with* the mother. These changes are more subtle, less open to inspection, than the patterns of cube behavior; but they are just as truly growth processes. They are of the same cloth as the change from diffuse to discriminating cube manipulation; from absorbed mouthing of one cube to recognition of another cube. Step by step, the things of the physical world and the persons of the social world take on configuration for the infant-child.
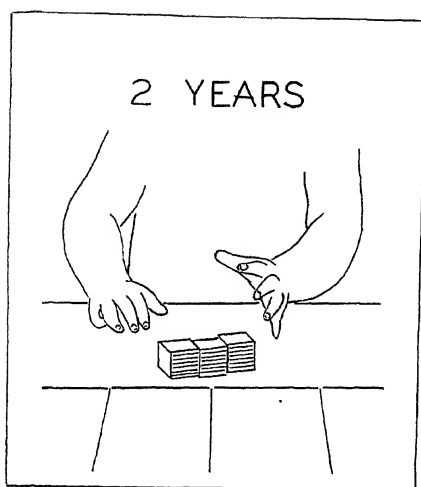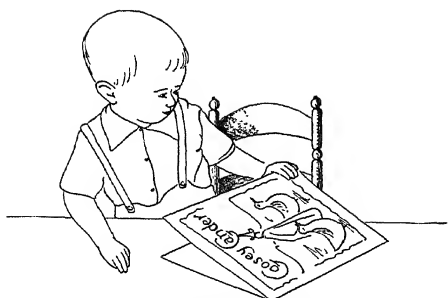
1. Turns pages singly

5. Imitates circular stroke
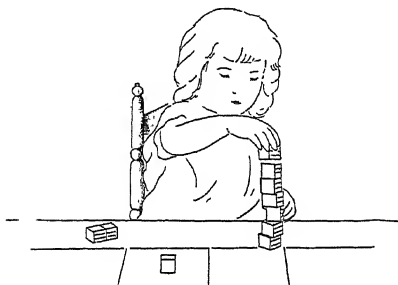
2. Builds tower of seven

6. Places blocks on board indiscriminately
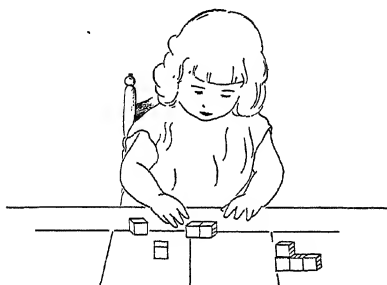
3. Aligns cubes

7. Adapts to reversal of board, four trials
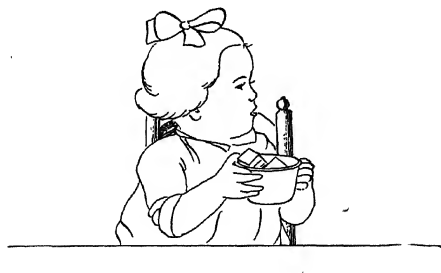
4. Hands cup of cubes to examiner

8. Identifies three to five pictures

9. Kicks ball
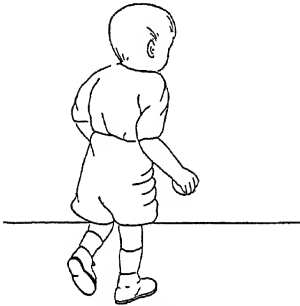
10. Runs fairly well

11. Inhibits overturning of spoon

12. Domestic play: feeds teddy bear

The 2-year-old seats himself with ease and addresses himself at once to the PICTURE BOOK on the test table. He *turns the pages singly* (1) and names a few pictures.

The MASSED CUBES are then presented and a "house" or tower is requested and, if necessary, demonstrated. The child responsively builds a *tower of 6-7 cubes* (2) which falls with the seventh or eighth. He may be urged to make the tower "high." In imitation of a 3-cube train with a fourth cube superimposed as chimney, he *aligns 2 or more cubes* (3). He fills the CUP with cubes and *hands it to the examiner* (4).

The DRAWING situation is presented. A blank piece of paper is placed on the table with a crayon on it in a central position. The child scribbles spontaneously. When a decisive vertical stroke is demonstrated, he *imitates the vertical stroke*; he is, however, unable to alter his direction in imitation of a horizontal stroke. A circular scribble is then demonstrated and he *imitates the circular stroke* (5), differentiating it clearly from the vertical stroke.

The FORMBOARD is presented with each block in front of its appropriate hole. He places the blocks on the board (6) without discriminating reference to the holes. After demonstration he *inserts the 3 blocks* correctly. The examiner now rotates the board 180° thereby reversing the position of the holes; the square block is in front of the round hole, etc. The child tries to insert the blocks; after much trial and error, and demonstration, he finally *adapts after 4 trials* (7).

The examiner now shows the PICTURE CARDS, points to the dog and asks, "What's this?" (Likewise with the shoe, cup, house, clock, etc.) After the child has named as many as he can, the examiner says, "Show me the dog," etc. The child *names 3 pictures* and *points to 5* (8).

The PERFORMANCE BOX is next placed on the table and the child is given the small red rod and asked to insert it in the middle hole. After one or two insertions, he is given the square block in its place. He *inserts the square* in the oblong hole, making the necessary adjustments; demonstration may be necessary.

He is then shown the TEST OBJECTS (pencil, shoe, penny, key, ball) in rapid succession, and asked to name them. He *names 2 of them*.

He is given the BALL and the table is moved so that he may stand and walk about.

He hurls the ball on request. He *carries out all four* of the following DIRECTIONS: Put it on the chair. Put it on the table. Give it to mother. Give it to me.

(He is tall enough to reach the ball in the performance box and so the situation is omitted.)

The LARGE BALL is offered and the child is asked to kick it. On verbal command alone, he *kicks the ball* (9), swinging his foot against it.

He is REPORTED to *run fairly well* (10) without falling, and indeed may habitually run rather than walk. He *walks up and down stairs alone,* bringing both feet to one step, then both feet to the next and so on. He often squats to play on the floor.

His mother estimates his VOCABULARY as well *over 50 words,* and jargon has been replaced by simple *3-word sentences.* He uses the pronouns I, me, and you though not always correctly. He soliloquizes, *verbalizing his immediate experience, referring to himself by name* ("Johnny slide, Johnny fall down.") He asks for food, toilet, and drink, and also asks for "another ————," wanting one for each hand.

He FEEDS himself part of his meals, not without spilling, but he *inhibits overturning the spoon* (11) until it is in his mouth. He handles a cup well.

He *verbalizes his* TOILET *needs* fairly consistently during the day, and he remains *dry at night* if taken to the toilet at 10 or 11 P.M. He co-operates in dressing and can even *pull on a simple garment,* as socks, mittens, or hat.

His PLAY with the doll or teddy bear includes *domestic mimicry* (12), as putting the doll to bed, etc., and he walks about pulling a toy. With other children he engages in *parallel play,* playing nearby and doing the same things, but not with mutual co-operation.

Normative Behavior characteristic of the KEY AGE: 24 MONTHS and adjacent age levels is codified by the *Developmental Schedules* shown on the adjoining page.

DEVELOPMENTAL SCHEDULES

21 Months	KEY AGE· 24 Months	30 Months
	Motor	
Walks: squats in play (*…) Stairs: walks down, 1 hand held (*24m) Stairs: walks up, holding rail (*24m) Large ball: (dem.) kicks (*24m) M. Cubes: tower of 5–6	Walks: runs well, no falling Stairs: walks up & down alone Large ball: (no dem.) kicks M. Cubes: tower of 6–7 Book: turns pages singly	Walks: (dem.) on tiptoe Jumps: with both feet Stands: tries stand on 1 foot M. Cubes: tower of 8 Drawing: holds crayon by fingers
	Adaptive	
M. Cubes: tower of 5–6 M. Cubes: imitates pushing train (*24m) Formbd: places 2–3 blocks Perf. box: inserts corner of sq. (*24m) Perf. box: retrieves ball	M. Cubes: tower of 6–7 M. Cubes: aligns 2 or more, train (*36m) Drawing: imitates V stroke Drawing: imitates circular stroke Formbd: places single blocks on (*30m) Formbd: adapts after 4 trials (*30m) Perf. box: inserts sq.	M. Cubes: tower of 8 M. Cubes: adds chimney to train Drawing: 2 or more strokes for cross (*36m) Drawing: imitates V and H strokes Color forms: places 1 Formbd: inserts 3 blocks on presenta. Formbd: adapts repeatedly, error (*36m) Digits: repeats 2 (1 of 3 trials)
	Language	
Vocab: 20 words Speech: combines 2–3 words spontan. (*24m) Ball: 3 directions	Speech: jargon discarded Speech: 3-word sentence Speech: uses *I, me, you* Picture cd: names 3 or more Picture cd: identifies 5 or more Test obj: names 2 Ball: 4 directions	Name: gives full name Picture cd: names 5 Picture cd: identifies 7 Test obj: gives use
	Personal-Social	
Feeding: handles cup well Commun: asks for food, toilet, drink Commun: echoes 2 or more last words (*24m) Commun: pulls person to show (*24m)	Feeding: inhibits turning spoon Toilet: dry at night, taken up (*36m) Toilet: verbal. needs fairly consist. (*42m) Dressing: pulls on simple garment Commun: verbalizes immed. experiences (*…) Commun: refers to self by name (*30m) Commun: compreh. & asks for "another" Play: hands cup full of cubes Play: domestic mimicry Play: parallel play predom. (*42m)	Commun: refers to self by pronoun rather than name Commun: repetit. in speech and other activ. (*36m) Play: pushes toy with good steering Play: helps put things away Play: can carry breakable obj.

TWO YEARS: Growth Trends

At 18 months he was an infant-child. At 2 years he may be considered a preschooler. He is graduating from infancy. He still has a residual stagger in his walk and he spends over half of the twenty-four hour cycle in sleep. But he is beginning to use words for communication, and he is able to meet at least for limited periods the demands of a nursery school environment. He gives evidences of a rudimentary sense of other persons,—a trait which becomes well defined by the age of 3 years.

The 2-year-old is still perfecting the fundamentals of locomotion and of postural control. He delights in running, because it is a new and formative ability. He is a run-about, preferring the novelty of running to walking. He usually manages to run without falling, but it takes him a full year more to learn to decelerate, to make sudden stops, and to turn sharp corners. Nevertheless he has sufficient inhibitions and social responsiveness to remain seated in a chair for most of the examination period. It takes time to acquire the motor poise and social conformability which distinguish the 3-year-old.

Fine manual co-ordination continues to progress at a steady rate. Accordingly he now builds a tower of 6 cubes. At 18 months it was a tower of 3; at 36 months it will be a tower of 9. The consistent gradualness of this improvement in fine motor control reminds us that growth proceeds by slow degrees. He cannot "learn" to build a tower of 6 all at once! It seems a bit illogical that a child who has the wit to build a tower of 3 cubes at 18 months should need on the average 2 months of additional age for each additional block in his tower prior to his second birthday; and that he should need 4 months of additional age for each block added prior to his third birthday. But such is the logic of neuro-motor development.

His mastery of spatial relations depends upon the organization of his neurones, especially those which supply the complicated systems of muscles which actuate eyes, hands, and fingers. An elementary command of the vertical dimension is expressed in his ability to execute a vertical stroke with a crayon, and to build a tower of 6 cubes. His ability to arrange three cubes side-by-side denotes a comparable command of the horizontal dimension. It is evidence of

increasing versatility. Oblique orientations, however, which lie be-
tween vertical and horizontal, are still far beyond his ken. Even at
3 years of age he cannot crease a paper obliquely; and not until 6
years can he copy a triangle—another reminder that perception of
forms develops by slow degrees because of the extraordinary deli-
cacy of the requisite neuro-motor equipment.

That the 2-year-old is still very much space-bound and at the
mercy of association by contiguity is shown in his reactions to the
formboard test. He readily places a circle in its proper hole at the
left (the square hole being at his right). He sees you rotate the board
slowly through an arc of 180° so that the circular hole is now at his
right instead of his left. Valiantly he tries to press the circular block
in the square hole. Three times you may reverse the board before
his eyes. He persists in his error. On the fourth trial he may finally
adapt. The 3-year-old typically adapts at once, or with immediate
correction of error. This does not so much represent a gain in a
mystical function called intelligence. It represents a differentiation
within the neurone mechanisms,—a product of natural growth only
secondarily aided by experience. Strictly speaking the 3-year-old is
not more intelligent than the 2-year-old. He is simply older.

The developmental problem of the 2-year-old is to get his realiza-
tions of formed space sufficiently disengaged from massive context
so that he can use them flexibly in his adaptive thinking. He has the
same problem with respect to language. His words hitherto have
been closely bound up with specific actions and limited situations.
He must disengage these words from their settings so that he can
use them freely as his agents. The period from 2 to 3 years therefore
is pre-eminently a period of transition, when jargon is discarded,
when objects and pictures are named, when pronouns are used;
and when simple directions are heeded. Just as he combined 3 cubes
in formed space to build a train, so he now can combine 3 words to
build a sentence. Both of these behavior patterns, one verbal, one
non-verbal, have much in common. Wide individual variations are
normal; but the 3-word sentence is rather typical of 2 years. Longer
sentences and taller towers are on the way; but they come later.

Sphincter control likewise takes developmental time. Adult man-
agement must supplement the child's inadequacies. The 2-year-old
is dry at night if he is taken up. He has to be taken to the toilet at

special times if he is to be dry during the day. Lapses occur because the cortical controls of volition reinforced by verbalization are still immature.

In the light of all his neuro-motor limitations we must not expect too many social graces in the 2-year-old. His realization of other persons is extremely rudimentary. He may like to have others around. He enjoys his solitary play more when other children are near by, provided they are not too near to interfere. He has more capacity to snatch, scuffle and kick than to give-and-take. This for reasons of developmental immaturity rather than downright depravity. His hugging is just as ill-measured as his pushing. He does not know how to ask for help; the need of asking is not clear to him because he is incapable of envisaging another person as disengaged from his own person. And yet he is at the very threshold of accomplishing just such socializing disengagements. This is shown by many tokens: he refers to himself by his own name; he sometimes says "you"; he understands and even uses the word "another"; he is interested in dolls; he mimics domestic events.

These characteristic patterns of behavior have a mixed personal and social reference. They arise out of formative proclivities which have their deep seat in the growing texture of the nervous system. The details of personal-social patterns are determined by the environment; but the moving, molding forces come from the child's own constitution. Therefore even the everyday manifestations of household behavior serve as indicators of the child's developmental maturity. We do not expect too much of the 2-year-old; and yet we wish to see these foretokens of socialized behavior which come to considerable and charming fulfillment at the age of 3 years.
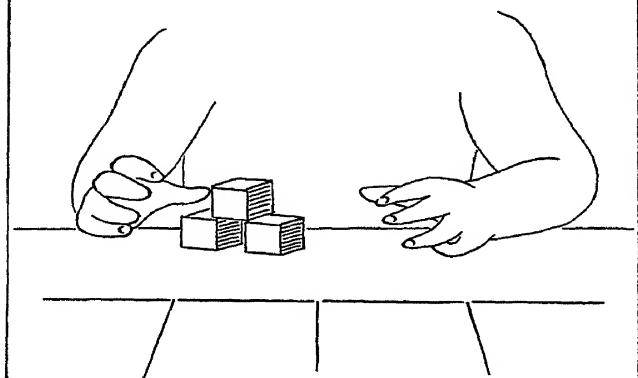
1. Builds tower of ten

2. Imitates bridge

3. Copies circle

4. Imitates cross

5. Matches three color forms
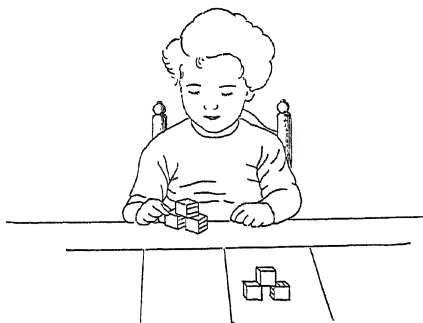
6. Adapts immediately to board reversal
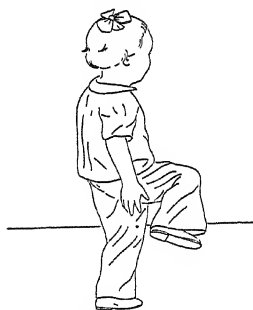
7. Stands on one foot momentarily

8. Pedals tricycle

84
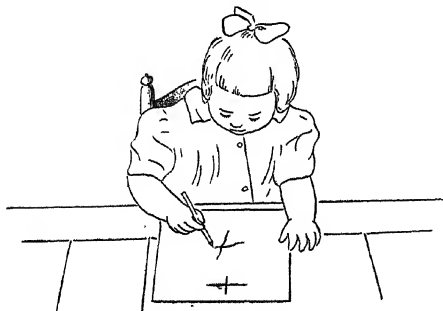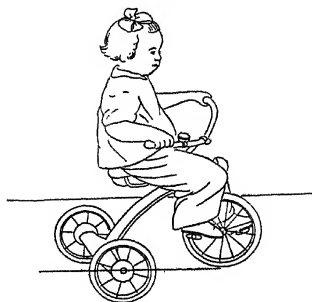
9. Feeds self with little spilling
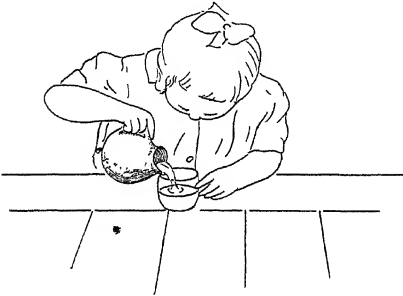
10. Pours from pitcher
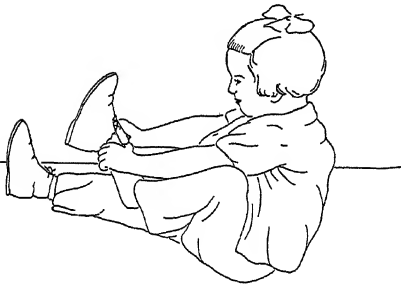
11. Pulls on shoes

12. Unbuttons accessible buttons

The 3-year-old accepts a chair readily and remains seated as long as the examination requires. He turns the pages of the PICTURE BOOK singly, names the pictures, and on behest *tells the action* delineated; e.g., the baby is sleeping. He knows a few rhymes and with a little encouragement may recite Little Bo-Peep or Little Miss Muffet, etc.

The MASSED CUBES are then presented and a "house" or tower is requested. The child *builds a tower of 9 cubes*, and in 3 trials a successful *tower of 10 cubes* (1). On demonstration of the model train (3 cubes with a fourth superimposed as chimney) he duplicates the model, chimney and all. Using 3 cubes, the examiner then demonstrates with running comment the construction of a bridge. The model is left standing and the child is given 3 other cubes. He *imitates the bridge* (2) accurately.

Given paper and crayon for spontaneous DRAWING, he holds the crayon with his fingers, rather than in his fist; he scribbles or scrawls, but in response to a question *names what he had drawn*. He imitates demonstrated vertical and horizontal strokes, differentiating them clearly. He *copies a circle* (3) from a model without aid of demonstration. He cannot copy a cross from a model, but after demonstration he crudely imitates the cross (4).

The placard carrying the 5 red COLOR FORMS is placed on the table and the child is asked to place the circle, square, triangle, semicircle, and cross, one after the other, where they "fit." The circle may be demonstrated. He correctly *matches 3 color forms* (5).

The FORMBOARD is now presented with each block in front of its appropriate hole. He inserts the blocks promptly. The examiner now rotates the board 180° reversing the position of the holes; the square block is in front of the round hole, etc. The child *adapts to the reversal without* error (6) or with *immediate spontaneous correction* of his error.

The examiner then shows the PICTURE CARDS, asking the child to name each picture in turn. He *names 8 pictures* correctly.

His immediate recall is tested by asking him to repeat the DIGITS 4-2, then 6-4-1, 3-5-2, 8-3-7. He repeats *one series of 3 digits* correctly.

On request he gives his full name and tells his SEX in response to the classical question, Are you a little boy or a little girl?

He is then asked three simple COMPREHENSION QUESTIONS: What must you do when you are sleepy? hungry? cold? He *answers one question* satisfactorily.

He names all the TEST OBJECTS and gives the use of a few of them.

He is given the BALL, and the table is removed to one side so that he may stand and walk about. He hurls the ball and then *carries out two* of the following PREPOSITION directions: Put the ball on the chair, under, in front of, beside, and back of the chair.

He kicks the LARGE BALL with facility but he can STAND *on one foot with only momentary balance* (7).

He is REPORTED to run well and to *walk upstairs alternating his feet* on consecutive treads, though he still walks down by bringing both feet to the same tread. He jumps on both feet, and can *jump down* from a height of 6-8 inches (as from the bottom step). He squats to play on the floor and he can walk on tiptoe. He *rides a tricycle* (8), steering and *using the pedals*.

His VOCABULARY contains innumerable words and he speaks in well-formed simple sentences, *using plurals*. He refers to himself by pronoun.

He FEEDS *himself well* (9) without help and *with little spilling*; he *pours well from a small pitcher* (10), gauging the capacity of the cup correctly.

He is *assuming responsibility* for his TOILET needs and is usually *dry all night*. He pulls on simple garments, *puts on his shoes* (11) (not always on the correct foot) and can *unbutton accessible buttons* (12).

Normative Behavior characteristic of the KEY AGE: 36 MONTHS and adjacent age levels is codified by the *Developmental Schedules* shown on the adjoining page.

DEVELOPMENTAL SCHEDULES

KEY AGE: 36 Months

30 Months	36 Months	42 Months
Motor		
Walks: (dem.) on tiptoe Jumps: with both feet Stands: tries stand on 1 foot M. Cubes: tower of 8 Drawing: holds crayon by fingers	Stairs: alternates feet going up Jumps: from bottom stair Rides: tricycle using pedals Stands: on 1 foot, moment. balance	Stands: on 1 foot, 2 sec.
Adaptive		
M. Cubes: tower of 8 M. Cubes: adds chimney to train Drawing: 2 or more strokes for cross (*36m) Drawing: imitates V and H strokes Color forms: places 1 Formbd: places 3 blocks on presenta. Formbd: adapts repeatedly, errors (*36m) Digits: repeats 2 (1 of 3 trials)	M. Cubes: tower of 9 (10 on 3 trials) M. Cubes: imitates bridge (*42m) Drawing: names own drawing Drawing: copies circle Drawing: imitates cross (*48m) Color forms: places 3 Formbd: adapts, no error, or immed correct. of error Digits: repeats 3 (1 of 3 trials)	M. Cubes: builds bridge from model Digits: repeats 3 (2 of 3 trials)
Language		
Name: gives full name Picture cd: names 5 Picture cd: identifies 7 Test obj: gives use	Book: gives action Speech: uses plurals Picture cd: names 8 Sex: tells sex Comprehen. Quest.: answers 1 Prepositions: obeys 2, ball & chair	Picture cd: names all Comprehen. Quest.: answers 2 Prepositions: obeys 3, ball & chair
Personal-Social		
Commun: refers to self by pronoun rather than name Commun: repetit. in speech activ. (*36m) Play: pushes toy with good steering Play: helps put things away Play: can carry breakable obj.	Feeding: feeds self, spills little Feeding: pours well from pitcher Dressing: puts on shoes Dressing: unbut. access. buttons Commun: understands taking turns Commun: knows a few rhymes	Dressing: washes, dries hands, face Play: assoc. play replaces parallel play

THREE YEARS: Growth Trends

Three is a nodal age. Three-year-oldness marks a kind of culmination in the processes of early development. The child is not yet completed; it will be a whole decade before he enters his teens. But in his own organization he has already achieved a full stage of pre-adolescence. When his developmental status at 3 years is compared with the callowness of infancy or even of 2-year-oldness, he proves to be a relatively mature being.

He is rather sure of himself. He is, for a period, well adapted to the culture in which he was more or less floundering at the age of 18 months. The collisions of that earlier age and the confusions of the age of two have been superseded by a rather well-defined sense of self, of appreciation of others, and of a realization of social demands. Both from the standpoint of motor hardiness and of acculturation he makes a good adjustment to nursery school and to excursions outside the home, including going to the doctor's office.

He is domesticated. He washes and dries his hands. He feeds himself with a spoon without much spilling. He sleeps through the night without wetting his bed. He takes responsibility for the toilet. (It would be full responsibility were it not for the awkward posteriority of buttons and buttocks.) He shows an interest in domestic routines.

This interest extends to events and environments outside the household. He is good company. He likes to please. He is heedful of words. He uses them as tools and builds them into sentences. His speech, to be sure, is almost limited to concrete situations. He does not verbally deal with generalizations and quasi-abstractions after the manner of the 5-year-old. But the child of 3 years does ask rhetorical questions. And frequently he asks "Is that right?" "Do it this way?" Such questions express his matured and maturing tendency to project himself into his cultural milieu, not only at home but abroad. He shows himself to be understanding of social requirements. He wants to keep himself within proper bounds.

This positive interest in conforming is a symptom of psychological growth. It represents a developmental gain. Of course, Nature sees to it that this conformability is not carried to excess. So the

4-year-old child in due season shows a strong tendency to go out of bounds. He (the child of 4 years) shows it in his speech, which is often fantastic in its flights and variegations. He shows it in his antics, his humor, his dramatizations, his runaway excursions into corridors, his imaginativeness, etc.

But again Nature sets metes and bounds to excess. So the 5-year-old tends again to stay more within bounds. He (the child of 5 years) is characteristically more compliant in formal situations and in social conventions. He feels a socialized pride in clothes and accomplishment. He is a self-assured, conforming citizen in his small world. He is indeed a very similar but more advanced edition of 3-year-oldness.

Such fluctuations from year to year and sometimes from week to week are part of the very physiology of development. They are like the reciprocal balancing of flexors and extensors; of left and right; of alternation and unison; of grasping and releasing; of positive and negative inhibition. How can the child learn "within-bounds" if he does not make a foray into "without-bounds"?

Some of the social amenability of the 3-year-old is also based on his greater psycho-motor maturity. He has mastered the essentials of walking, running, dodging, throwing, stop-go, and turn. And when he walks he goes with a destination in mind. He has a practical command of the principles of the lever. He manages a spoon. He holds a crayon adaptively, and makes it obedient to curved as well as straight lines. When he wields a paint brush designs take shape. He has an elementary sense of order. Given 4 random cubes, he tends to assemble them into a neat square. He builds a bridge of 3 cubes. He deploys his hand with an intentfulness which in the race led to tool using and primitive art.

Indeed the configured psychology of the 3-year-old is dimly suggestive of a primitive stage of culture in the evolution of the human race. Ontogeny no doubt has introduced displacements which no longer correspond to the primitive phylogenetic status. But the 3-year-old embodies many of the fundamental behavior traits of human culture. He recognizes others and "otherness." He can wait his turn. He can bargain. He can co-operate in play with other children. He likes to participate as well as to play alone. He is achieving a dissociation of spoken words from corresponding body movements and postural sets. This will enable him in due time to use words as

vehicles for free floating ideas, which is the supreme behavior pattern of man as a maker and bearer of culture.

These cultural allusions are far from academic. They concern developmental diagnosis; for even in the first years of life it is often necessary to make a diagnostic appraisal of the emotional maturity as well as of the motor maturity of a child. Retardations and deviations occur in the emotional as well as in the sensori-motor aspects of development. These retardations and deviations reflect themselves particularly in personal-social items of behavior. Although we must not unduly exalt the psychological attainments of any age it is well to bear in mind what we may expect under normal conditions in the personality of a 3-year-old child.

CHAPTER IV

THE CONDUCT OF THE EXAMINATION

We are now in a position to consider the general management of the developmental examination as an integral part of medical practice. In the previous chapters we have shown that the examination is essentially a diagnostic device for determining the functional maturity of the nervous system. A behavior test has the same logic as any of the functional tests of clinical neurology, such as the finger test for co-ordination; the cover test for pupillary response; the tendon tap for a jerk reflex. Behavior tests are equally competent to disclose lesions, defects, and retardations in the organization of the nervous system. They are indeed designed to expose failures and distortions of development. They are also designed to establish normality and to reveal minor deviations in relatively normal children.

There can be no doubt that the developmental examination can serve to make you more fully acquainted with significant characteristics in the individuality of the child with whom you have to deal. Fortunately the behavior tests are so interesting to the child that the developmental examination will help to establish friendly and confident relations with your young patient. The examination may be deliberately capitalized for this very purpose. It will naturally precede rather than follow any physical examination or therapeutic measures. It may even facilitate the physical examination.

The conduct of a developmental examination involves three steps: (1) a preliminary interview, (2) the formal behavior tests in an established order, (3) a record of the results and a diagnostic review of the examination as a whole. Each of these steps will be briefly considered in turn.

§ 1. Preliminary Interview

Ordinarily the preliminary interview should be short and orientational. Lengthy discussion of problems or difficulties may well be postponed, and in any case should not be undertaken in the presence of the child.

The interview is conducted in an informal, friendly manner, aimed to put the child and parent at ease. If the infant is sensitive to strangers, or if the child is wary, it is good policy to delay any direct overtures to the young visitor and to give chief attention to the mother. This seeming neglect will of itself tend to disarm the child. He will conclude that the doctor has no violent designs upon him, and as confidence takes root you may tentatively offer him a toy (such as the linked rings, shown in Fig. 1) during the course of the questioning. If he does not accept the proffer he needs more time to make his initial adjustment. When he accepts the toy freely from your hands, he has accepted you. It is then usually safe to proceed—though not too abruptly—to the examination. Rapport with the child should be established before beginning the behavior tests. The interview thus becomes the preparatory stage for the formal part of the examination.

As has been stated the interview is friendly and informal rather than inquisitorial. The questions should be so phrased that their meaning is clear and correct answers are not too frequently suggested; they should be so selected that the mother is not too often embarrassed by her inability to reply in the affirmative.

The following outlines give a fairly complete list of the questions that may be asked in the preliminary interview. They cover the four fields of behavior and the age range from 4 weeks to 3 years. The wording that we have found most successful in eliciting accurate and natural responses from the mother is given for its usefulness rather than for its elegance. Each examiner formulates his questions in his own way, of course, the answer to one question often changing the form of the next; rigid adherence to a standard form is neither expected nor desirable.

Obviously the whole age range is not covered in any one interview. The physician gets his initial orientation from the child's true chronological age and from what he sees. The very first questions

and observations—Does he sit alone, Does he creep, Does he walk? —place the child at once in a certain developmental zone in the motor field: he is a sitter, a creeper, or a walker. Lines of inquiry relating to this field are grouped under functional headings to facilitate the selection of appropriate questions. The examiner explores the child's behavior in his developmental zone, pushing the questions toward the next higher zones until the upper limit of the child's motor abilities is ascertained.

Having explored the motor field, the language field is investigated next. The orientation here is governed partly by the child's true age and partly by the zone already established in the motor field. Again the answers to the first questions serve to place the child at once in a certain developmental zone. To the question, "What does he say?" the mother may answer, "Just baby sounds." "Dada." "He says bye and hello." Questions in the language field are grouped under age zones. The appropriate zone is explored, and the questions are spread toward the next higher zones until the upper limit of the child's language abilities is revealed.

The adaptive and personal-social fields are investigated in the same way. The order suggested is one which we have found conducive to good reporting.

After the personal-social behavior has been discussed, it is very natural to inquire into the child's personal reactions to his environment and his routines. The questions appended under the heading Emotional Behavior are constructed to this end. Their purpose is not to inquire into specific problems, or to suggest problems, but to give the mother an opportunity to tell about any difficulties she is having. Many of her problems will prove to be quite normal when regarded in the light of natural developmental sequences. Other problems may be sufficiently revealing of the personality make-up of the child to enable the physician to advise the mother in management, routine, and interpretation.

A planned interview with a selective series of questions covering all fields of behavior cannot fail to furnish fundamental information concerning the child's maturity, his accustomed modes of behavior and the prevailing parent-child relationships. In practice (and with practice) the preliminary interview usually takes only five to ten

minutes. The interview is not as onerous as the long list of subjoined questions may suggest. To repeat, only a few questions in each field are asked at any age. To illustrate, a sample interview record will be presented at the conclusion of the outline of questions. It will be noted that a fairly comprehensive interview can be summed up in a few words.

<div align="center">SUGGESTIVE OUTLINE OF INTERVIEW QUESTIONS</div>

<div align="center">MOTOR CAPACITIES</div>

1. HEAD CONTROL (4-28 WEEKS)

Is he beginning to hold his head up himself? Is it pretty *wobbly*? Is his head pretty *steady* now? Can he *lift* his head when he's lying on his stomach? Can he hold it up? When he's lying on his back, does he lift his head off the pillow as though he were *trying to sit* up?

2. SITTING (16-40 WEEKS)

Do you sit him up *propped* with pillows? How long will he sit before he slides down? Is he beginning to sit by himself now? Is he likely to fall? Does he *sit alone* well enough so that you would sit him on the floor and then go out of the room?

3. CREEPING (28-40 WEEKS)

Does he move around at all when he's on his stomach? Can he go around in a *circle*? Does he get up on his hands and knees? Does he *creep*? How does he creep—on his hands and knees, or does he pull himself along on his stomach (crawling)? Does he creep on his hands and feet? When he's sitting, can he get over onto his stomach by himself? (If he doesn't creep.) Does he hitch along, sitting down, or has he any way of getting around by himself on the floor?

4. STANDING (28 WEEKS-12 MONTHS)

When you hold him standing up, does he take any *weight* on his feet? Does he step or does he like to *jump up* and down? If you stood him up in his crib or play pen, would he *hold on and stand* there by himself for a little while? Can he *pull himself* up to his feet in his crib or play pen? Does he try at all? How far does he get? Does he *walk around* his play pen holding on, or just stand there? Can he get down again, or does he fall,—or does he cry for you to help him? Does he walk if you *hold his hands*? Do you have to hold both hands, or *only one*? In his play pen, does he ever forget to hold on for a minute and *stand alone*?

5. WALKING (15 MONTHS-3 YEARS)

Does he *walk* alone? Is it just a few steps into your arms, or can he stop when he wants to? Can he *get up on his feet* in the middle of the floor without holding onto anything? About how old was he when he began to walk alone? Now that he can walk, does he ever creep any more? Can he *run*? Does he really run, or just walk fast? Can he go *up stairs*? Does he *creep up* on his hands and knees or does he walk up? Does he hold the bannister? How about *down stairs*? Does he back down or bump down? Does he walk down, holding the bannister or your hand? Does he bring both feet to the same step, or go up and down the way you do? Can he *sit down in a little* chair by himself, or is he likely to miss it? Can he climb into a big chair? Can he get down again? Does he *squat* down to play on the floor or is he more likely to sit on the floor? Does he fall much? Can he *jump*? Jump down from the bottom step? Can he *ride a tricycle*? Does he use the pedals and steer?

LANGUAGE BEHAVIOR

(Type·questions: What does he say? What does he understand that you say to him?)

4 WEEK ZONE

What sounds does he make? Does he *smile* when you talk to him? Does he follow you with his eyes as you walk around the room?

16 WEEK ZONE

Does he *coo*? Can you get him to *"talk back"* to you? Does he *talk to himself* when he wakes up in the morning? Does he *laugh aloud*? Is it a real laugh or does it sound more like a chuckle? When he's talking to himself, does he seem to be playing with his voice, making it go up very high and then listening? Does he *squeal*, very high, when he gets excited?

28 WEEK ZONE

Does he *talk to his toys*? Does he say *"mama"* or is it just when he is crying? What other sounds does he make?

40 WEEK ZONE

Does he say *"dada"*? Does he mean you when he says *"mama"*? Does he *imitate* sounds? If you cough or click your tongue, will he do the same thing? What does he understand that you say to him? His name, No-no? Does he understand if you say "Where's daddy?" Will he wave *bye-bye* or *patacake* if you ask him to without showing him how? Has he any

words? Does he use any sounds to mean something, even if it doesn't sound like the real word, like "nana" for food? Does he shake his head yes and no?

12 MONTH ZONE

What *words* does he say, besides mama and dada? Does he understand if you ask him to stand up, sit down, come here? If you ask him for something he has in his hand, will he *give it* to you? Does he know some of his toys by name—"Where is your ball?" would he look? Is he beginning to jabber?

18 MONTH ZONE

Has he any *words* for his toys, like ball, doll, car, etc.? Has he any words for food, like milk, cookie, etc.? Has he any words for his clothes, like shoe, hat, sox, etc.? How about words like no, hello, bye, night, bed? About how many words do you think he has, 5—10—20? Does he *jabber* a lot, so that it sounds like a foreign language you can't understand? (In cases of very retarded speech development—Are you sure he hears?)

2 YEAR ZONE

If you had to guess how many *words* he has, would you say 10—25—50—100, or are there so many you can't keep track of them? Is he beginning to put *two words* together at all, two words that join two ideas, like "daddy go," "bye car"? Can he name a *few pictures*? Could he go and get something for you out of the next room? What does he call himself? His name or does he say *I, me*?

3 YEAR ZONE

Is he beginning to use *sentences*? Can you tell me something he said yesterday or today, to give me an idea of the kind of sentences he makes? Does he *give his name* if you ask him for it? His last name, too, or just his first name? Does he talk pretty plainly? Can anyone understand him or are you the only one? Could you send him into the next room for *two things*? Would he remember to bring them both?

ADAPTIVE BEHAVIOR

(Type questions: What does he like to play with? How does he play with it?)

4 WEEK ZONE

Does he pay any attention to *toys*? If you put one in his hand does he *drop it* right away?

16 WEEK ZONE

Will he *hold on* to a toy you give him? Does he look at it while he's holding it?   .

28 WEEK ZONE

Do you have to give him his toys or will he *reach right out* and get them himself? How does he play with his toys? Have you seen him pass a toy from one hand to the other, back and forth (*transfer*)? Does he put it to his *mouth*? Does he really bite on it? If he drops a toy will he try to *get it again*, or is it just "gone"?

40 WEEK ZONE

Can he pick up something very *small*, like a crumb or a thread? Does he play with *two toys at once*, one in each hand, or does he usually play with just one at a time? Does he hit two toys together (*combine*)? (In cases of very retarded development of adaptive behavior: Are you sure he can see?)

12 MONTH ZONE

Does he like to put toys *in and out* of a box?

18 MONTH ZONE

Does he play with blocks? Does he *pile* them, one on top of another? Does he like to play *ball*? How about picture books or magazines? Does he *turn the pages* or just tear them? Does he know any of the *pictures*? Could he show you the picture of the baby or the dog if you asked him? Does he like to *pull a toy* on a string around after him? Has he a doll or teddy bear to play with? How does he play with it; does he just *carry it around* and love it? Which hand does he use most? Do you think he's right or left handed? Have you tried to make him use his right?

2 YEAR ZONE

Does he pretend to put his doll or teddy bear to bed, cover it up, etc. (domestic mimicry)? Does he like you to tell him stories about *pictures*?

3 YEAR ZONE

Does he like to push a toy car around? Does he steer it well? Does he like to *help you* with the beds and dishes, put things away? Does he *build houses* out of blocks? Does he know any little *songs or rhymes*? Do you have to help him or can he do it all by himself?

(Headings: Feeding, dressing, toilet, domestic play, and co-operation.)

4 WEEK ZONE

How many night feedings (after 7 p. m.) does he have?

16 WEEK ZONE

Does he like to *look at his hands*? Does he hold them up in front of his face? Does he bring his hands together? Does he get *hold of* his *dress*? Does he pull it way up over *his face*? Does he *know* his *bottle* when he sees it? Does he put his *hands on it*?

28 WEEK ZONE

Does he know you? Would he make a *difference between* you and me, or wouldn't he care if I took him? Does he notice his *feet* when he's lying down? Does he get hold of them? Does he put them in his mouth? Is he getting any cereal or vegetables now? How does he take them? Does he *swallow them* well or does he still have trouble managing them?

40 WEEK ZONE

Does he *hold his own* bottle or do you hold it for him? Is he beginning to drink any of his milk from a cup? How does he take it? If you gave him a *cracker or zweibach in his hand* what would he do with it? Does he do a good job? Does he wave *bye*? Or *patacake*? Do you have to get him started? Does he play peekaboo? Does he cover his own face or just laugh when you do it?

12 MONTH ZONE

When you *dress him*, does he help at all, put his arm through the sleeve, or put his foot out for the shoe? Have you tried to train him for the *toilet* at all? Just for his bowels or for wetting too? How is it going?

18 MONTH ZONE

Does he drink from a *bottle or cup*? Does he have a bottle at night? When you feed him, can you leave the dish on the tray where he can reach it? Is he beginning to *feed himself* at all? How much do you help him? Is it a pretty messy job? Does he hold the *cup* himself? Does he spill? When he's finished drinking does he put the cup down or does he

drop it or throw it? How is he about the *toilet*? Can you keep him dry all day if you're careful? Would he wait a little while for you to take him if he needed to go to the toilet, or would he wet? About how many "accidents" a day does he have? Has he any way of *telling* you he needs to go to the toilet? How does he let you know? Does he *tell* you *after* he is wet? Is he dry when he wakes up from his nap?

2 YEAR ZONE

Can he fill the *spoon* and get it to his mouth without turning it upside down? Is he pretty reliable about the *toilet* now? Does he pretty nearly always *tell you* when he needs to go to the toilet? Can you keep him *dry at night* if you take him up when you go to bed, and go to him first thing in the morning? About how many nights in the week is he dry at night? Does he try to *dress himself* at all? Can he get anything on by himself? Does he play with *other children*? Does he like to have them around? Do they pay much attention to each other?

3 YEAR ZONE

Does he *feed himself* all his meals? Does he do a good job of it? Can he *pour his own* milk from a small pitcher? Can he put on *his shoes* himself? Can he *unbutton* the buttons he can reach? Does he like to *help you* with the housework? What does he do?

EMOTIONAL BEHAVIOR

Is he a good baby (boy, girl)?

Does he amuse himself pretty well, or does he want someone with him all the time? Does he cry when you leave him?

Does he eat well? Good appetite? Is he fussy about new foods? Is there anything he just won't eat? Did he mind giving up his bottle?

Is he good about going to sleep? Does he sleep all night? Does he call you as soon as he wakes, or does he wait till you go to him? Does he take things to bed with him to help him to go to sleep? What things?

Does he mind being taken to the toilet?

Does he mind you (obey) pretty well? Does he get mad? What makes him mad? What do you do then?

Is he afraid of anything? Do you know how it started? How is he about strangers? Strange places? Does he see many people or go about much?

Do you always have to do things for him just the same way? Do changes in routine bother him?

Is there anything he does that worries you? Tell me about it.

ILLUSTRATIVE BEHAVIOR INTERVIEW

Name: *Jane Doe*   Age:*40 wks.*   Date:*6-10-40*   CCD No.

Informant: *Mrs. Doe*

Relationship to child: *Mother*

Motor behavior (include handedness and manner of manipulation of objects)

Sits alone well
Creeps all over the house
Pulls to her feet and stands—no cruising—lowers self
Steps when hands held, no walking

Language behavior (include gestures)

dada and mama	Comprehends	*name*
baba (bottle)		*no*
imitates sounds		*patacake, bye*
		where's daddy

Play behavior (include toys)

Plays with toys, bangs together
Picks up crumbs
Pokes into holes
No in and out play

Domestic behavior (feeding, dressing, toilet, co-operation)

Takes part each feeding from cup, chokes, refuses
Holds bottle, feeds self cracker
bm. regularized

Emotional behavior (dependency, management, playmates, specific behavior deviations)

Good baby, plays alone happily
Friendly with strangers if not approached too fast
Sleeps all night, sucks thumb at sleep time
Some resistance to cup—takes new foods well

Health history

2 teeth
has been well since last visit

§ 2. ORDER OF THE EXAMINATION

During the interview you had an opportunity to note the child's spontaneous behavior and postural control. Your impressions together with the answers to the interview questions have given you a general idea of the child's maturity. You do not yet know the precise levels of his abilities, but you have ascertained enough to determine what sequence to use in conducting the developmental examination.

The accompanying table lists eight examination sequences which show the recommended order of the behavior tests for each of the age zones corresponding to the eight key ages: 4, 16, 28, 40 weeks; 12, 18, 24, 36 months. You will note that this forms a graduated but flexible series of sequences from which to choose. No sequence differs drastically from the next adjacent sequence. (The new behavior situations which appear are progressively indicated by asterisks.)

Naturally the sequences for 4 weeks and 16 weeks begin with the *supine situations*. The 28 and 40 weeks and the 12 months sequences assume a child who can *sit* supported or unsupported. The 18, 24, and 36 months sequences assume an *ambulatory* child who can be seated in front of a small table.

In choosing the proper examination sequence, first determine whether the child best fits the supine, seated, or ambulatory category. If there are no contraindications, select the sequence which is nearest to his chronological age. If there are obvious deviations, defects, or retardations, make due allowances. However, having selected one sequence do not fail to shift to a more advanced sequence if the child's performance so demands. Your aim is to ascertain the maximum levels of his abilities and it is desirable to stretch his adjustment toward the maximum by shifting to items in the next advanced sequence. For example, you are examining a 32-week-old child on the 28 weeks sequence; he has given such excellent performance on the Single Cubes and the Multiple Cubes situations that you introduce the Cup and Cubes situation which does not appear on the 28 weeks sequence, but is listed on the 40 weeks sequence. You may even shift entirely to the 40 weeks sequence. Adjacent sequences are so closely related that such shifts do not entail any serious readjustments. The main point is that the child's

EXAMINATION SEQUENCES

Supine	
4 Weeks Zone 0 − 4 − 8 weeks	16 Weeks Zone 12 − 16 − 20 weeks
Interview Supine Dangling ring Rattle Bell ring Social stimulation (Pull-to-sit) Sit–supported Stand–supported Prone	Interview Supine Dangling ring Rattle Bell ring Social stimulation Pull-to-sit Sit–supported *Chair—TT *Cube 1 *Cup–inverted *(Pellet) *Bell Stand–supported Prone

Sitting	
28 Weeks Zone 24 − 28 − 32 weeks	40 Weeks Zone 36 − 40 − 44 weeks

Interview
Chair—TT
*Cube, 1, 2, 3
*(Multiple cubes)
Pellet
Bell
*Ring and String
(Supine)
(Dangling ring)
(Rattle)
(Bell ring)
Social stimulation
Pull-to-sit
Sit–supported
*Mirror
Stand–supported
Prone
	Interview
	TT
	(Cubes 1, 2, 3)
	Multiple cubes
	*Cup and cubes
	(Pellet)
	*Pellet in bottle
	*Pellet beside bottle
	Bell
	Ring and String
	*(Formboard)
	*Ball play
	Mirror
	*Mirror and ball
	*Posture
	    Sit–free
	    Creep
	    Rail
	    Cruise
	    Walk–supported

( ) = Situation sometimes omitted for special reasons.   TT = Test Table

Locomotor

12 Months Zone 48 — 52 — 56 weeks	18 Months Zone 15 — 18 — 21 months
Interview	Interview
TT	*Picture book
(Cubes 1, 2, 3)	Cubes
*Tower	Tower
Multiple cubes	Train
Cup and cubes	Cup and cubes
Pellet in bottle	Pellet and bottle
Pellet beside bottle	*Drawing
Ring and String	Spontaneous
Formboard	Scribble
Ball play	Strokes
Mirror	Circular scribble
Mirror and ball	Formboard
Posture	*Picture card (a)
Sit–free	*Performance box
Creep	*Test objects
Rail	*Small ball
Cruise	Throwing
Walk–supported	Directions
	In box
	*Kicking
	Posture: Sit–chair, walk, run

Pre-kindergarten

2 Years Zone 21 — 24 — 30 months	3 Years Zone 30 — 36 — 42 months
Interview	Interview
Picture book	Picture book
Cubes	Cubes
Tower	Tower
Train	Train
Cup and cubes	Bridge
Drawing	Drawing
Spontaneous	Spontaneous
Strokes	Strokes
Circular scribble	Circle
Formboard	Cross
Picture cards	*Color forms
Performance box	Formboard
Test objects	Picture cards
Small ball	*(Digits)
Throwing	*(Name, sex)
In box	*(Comprehension)
Kicking	Small ball
Posture	Throwing
Sit–chair	Prepositions
Walk, run	Kicking
	Posture: Run, jump, stand 1 foot

demonstrated abilities and drives should finally determine the tests that are used. But the standard order in which the tests appear on the sequences should be maintained as far as possible.

With a little finesse it is relatively simple to make a smooth transition from the interview to the formal examination. If the child is playing with a toy at the close of the interview, he is permitted to retain the toy which may be removed as soon as the cubes are presented. He either drops the toy in hand in response to the new, rival toy or you gently extract it at the moment of cube presentation. By a similar ruse you may have to remove the cube before the next test object (the pellet) is presented. Some children cling more tightly than others to an object in hand. Most of them, however, make a prompt adjustment from one object to the next; and once the examination is under way there is little difficulty in accomplishing transitions. However, since the examination in its entirety is a single unit, you are interested in the transitions as well as the tests *per se*; the transitions are part and parcel of the examination, neither to be overlooked nor regarded as impediments.

The examination sequences are of course adapted to the age and maturity of the child. There is a rationale in the order of the tests. Cubes are used at or near the beginning of most of the schedules because the cubes have universal ingratiating appeal. The seriated cube presentations build up an anticipation in the infant which projects itself into the ensuing situations. He soon expects you to give him something new to do. This expectation properly guided and satisfied imparts flow and dynamic progression to the examination. Postural tests in general are deferred to the end to reduce any possible disturbing effect and to give the child more free play on the examination table or the floor.

It is impracticable (and unnecessary) to allot a specified amount of time to each of the behavior situations. You will learn empirically how soon the child is ready for the next test situation. Sometimes, as in the pellet test, a few seconds of exploitation may suffice. But if he shows great eagerness and versatility in his exploitation of the bell, for example, you may permit him to manipulate it for a minute or more. You will also find that certain modes or cycles of exploitation tend to repeat themselves. Such cycles are characteristic patterns of activity. They afford a clue to the timing of the tests.

With skillful management, interest in the test materials mounts as the examination proceeds. No situation is allowed to drag or even to exhaust itself. Tempo is the thing. It differs with each child, because each child has embodied in the structure of his nervous system a characteristic action tempo. One child may run through the whole series of test situations in less than ten minutes. Another, for reasons of tempo plus emotional factors, may take twice as long.

Interest should not be allowed to wane. It bogs down the examination to make elaborate recordings. One situation should shift into the next with a smooth swing. Occasionally the recommended order may be altered to suit child or exigency. But tempo should always be freely regulated to meet individual requirements. That tempo is best which stimulates, builds up, and sustains interest.

§ 3. RECORDING AND REVIEW

Although a carefully conducted interview will yield valuable information concerning the child's maturity, you will wish to check and to evaluate this information by a first-hand inspection of the child's behavior patterns. That, of course, is the function of the formal behavior examination. You will also wish to have a record of some sort in your case file. Your immediate objective, however, is an adequate view of the child's behavior equipment.

The detail of the final record will depend on circumstances and needs. Some examiners can readily make a few pencilled jottings during the course of the examination without interfering with the tempo. Others prefer to write out a succinct summary at the conclusion of the examination.

It is also possible to train an assistant to observe the examination and to write out a more or less complete account of the total flow of the behavior. Ideally such a recorder should be seated in an inconspicuous corner of the room where she offers no distraction to the examination. Still better she may be stationed behind a one-way vision screen (as described in Appendix C) which can be easily installed in any office. When a stenographic recorder is available, observations may be dictated at the very moment they are being made. A quietly dictated record rarely interferes with the conduct of the examination and it supplies especially valuable data in complicated cases requiring long supervision. A minimal record will

consist of plus and minus signs entered on the developmental sched-
ules which were presented in Chapter III. Detailed directions for
recording and evaluating behavior are given in Appendix A. Suffice
it to say that the plus and minus signs do not automatically deliver
a diagnosis.

Here, as in all diagnosis, clinical judgment must always be
brought to bear. Through experience and study the examiner has
familiarized himself with the kind of behavior which may be ex-
pected at each of the progressive key ages. He will have a fairly
well defined normative mental image of the behavior characteristics
of a representative, normative child at a given key age. He will also
have an image of the behavior characteristics which he has just
witnessed. To arrive at a clinical appraisal he resorts to a simple
process of matching, not unlike the matching of a blood sample on a
calibrated hemoglobin scale. He matches the witnessed behavior
picture against the normative image, for the child as a whole, and
separately for each of the four behavior fields. For example, he
estimates the child's motor development as being at age, retarded
(below age), or accelerated (in advance of age). Objectively con-
trolled by the age norms embodied in the developmental schedules,
such critical comparison approximates measurement. Judgment can
be shaded up or down in terms of maturity, and the performance
of the child can be finally expressed in terms of developmental age.

After a consideration of the behavior pictures which are found in
the various clinical conditions discussed in Part Two, we shall be
in a better position to outline the special procedures for arriving at
differential and descriptive diagnoses.

The success of all diagnosis and still more of prognosis naturally
depends upon clinical experience. After the physician has applied
the behavior tests to a few normal infants of varying ages, he will
begin to order his experience; the behavior patterns will take on
vivid identity. With further experience the patterns take on diag-
nostic significance. He will then discover how the behavior of
atypical and defective children deviates from the normal. He will
recognize deviations as symptoms of maldevelopment. The appraisal
of these symptoms is the art of developmental diagnosis.

PART TWO

DEFECTS AND DEVIATIONS OF DEVELOPMENT

CHAPTER V

PROBLEMS OF DIFFERENTIAL DIAGNOSIS

The chapters in this section deal with the clinical manifestations of abnormal and atypical development in infancy. The problems are always those of diagnosis and prognosis. What are the causes of the deviation? What is the developmental outlook? Is there any therapy that is curative or ameliorative? Taking the outlook, the possibilities of treatment, and the family situation into consideration, what is to be done?

The subject is enormously complicated by the fact that we are always dealing with a growing organism, one which has a past development, is developing now, and which has a developmental future. In the normal infant, development is methodical, orderly and timed; it goes through a gradient that can be divided into ordered sequences which follow each other with such regularity that they are in the main predictable.

In the abnormal infant the rate of development is primarily affected; retardation is nearly always the most obvious symptom. Secondarily, development is more or less distorted; behavior patterns may be deformed or hypertrophied or they may fail to appear. The amount of retardation and the degree of distortion depend upon the etiological factors, their nature, severity and time of occurrence in the life cycle.

The origin of abnormal development may date back to the *germinal period*. Gametes carrying defective genes in unfavorable combinations produce a defective organism. When this germinal defect involves the very potentials of developmental maturation, the result is primary constitutional mental deficiency. "Endowment" is a convenient term used to describe the developmental potentialities in-

herent in an individual, determined by his genes at the time of conception. The endowment of an ament is limited from the very beginning. Growth potentialities may be impoverished to an extreme degree; growth potentialities may be abiotrophic, the developmental impetus expending itself early; growth potentials may show a marked or moderate reduction but still be hardy enough to produce a consistent, slow development over a long period of time.

In the *embryonic period* the physiological regulation of somatic growth may be faulty. At this time such abnormalities as coloboma, hare-lip, spina bifida and hypertelorism develop because of defective time-space factors in the mechanics of growth. Cerebral aplasia and maldevelopments such as encephalocele, oxycephaly, cortical hemangioma, sclerosis, porencephaly, and hydrocephaly, etc, develop in a similar manner at this same time. The disturbance in growth may be due to genetic factors or to biochemical influences from the maternal host, or to a combination of both.

The germinal and embryonic development may be normal and the growth potentialities may yet come to grief in the *fetal period.* Maternal toxemia, syphilis, possibly other more obscure infections, and the hazards of premature birth may at this time attack the integrity of developing nerve tissue.

The *circumnatal period* has its own peculiar dangers to growth potentials. The physical trauma of birth itself, no matter how "easy," may cause massive or multiple minute hemorrhages. Anoxemia and icterus can result in the death of nerve cells; drugs such as quinine may play a damaging role. Hemorrhagic disease of the newborn is peculiar to this period as is erythroblastosis fetalis. The neonate is particularly susceptible to infections. And so the list grows.

Even after independent *postnatal life* is well established, the infant is not immune to hazards. The list of infections, traumas, and toxic agents that may injure him is almost endless. As in earlier periods, the injury may be great or small; or it may be selective, leaving certain growth potentials unimpaired. His new environment exposes him to another source of insult, namely that of experience. Poverty of experience such as is encountered in institutional life or in sensory deprivations as blindness and deafness, malignant experience such as cruelty, lack of kindly understanding care, parental rejection, serious accidents, etc., may affect emotional development and in turn,

behavior development. Thus normally-endowed children whose experiences have been unusual or whose emotional stability and personality make-up are more or less inadequate to meet ordinary experiences may show a retardation *symptomatic* of the underlying conditions.

The hazards of development are so numerous that one may wonder that normality is ever achieved. The answer lies in the factors of safety and in the tendency toward the normal inherent in all developmental processes.

The task of diagnosis is to make distinctions between retardations that are inborn and those that are acquired; to distinguish between retardations that are permanent and those that are symptomatic. We have to recognize mixed types and partial syndromes. The accompanying chart classifies the defects and deviations of development on the basis of their causative factors.

THE DEVELOPMENTAL QUOTIENT

Diagnosis and prediction are inseparable in dealing with developmental problems. Each time a diagnosis is made, a prognosis is implied. If retardation is present, accurate diagnosis determines whether the future probabilities are in favor of deterioration, consistent progress at a reduced level and rate, or improvement.

In the absence of progressive retardation on the one hand and of symptomatic retardations on the other, consistent development is the rule. With the exceptions noted, development takes place at a relatively consistent rate without extreme accelerations or declines. In other words, a normal infant becomes a normal child and a normal adult; a subnormal infant, a subnormal child and adult.

By application of the norms set up and described in the preceding chapters, we are able to compare the developmental status of any child with the norms appropriate to his age, and to determine whether he deviates from the norms, in what direction he deviates, and how much he deviates. In other words, we ascertain the completeness as well as the rate of his development; we make qualitative and quantitative comparisons.

When consistent development can be assumed, the premise is that the amount of deviation remains proportionally constant. Four weeks of retardation at the age of 8 weeks lengthens into 12 weeks of

ETIOLOGICAL CLASSIFICATION OF DEVELOPMENTAL DEFECTS AND DEVIATIONS

I. *Defective Development* (amentia, mental deficiency, feeblemindedness)

Primary

Simple deficiency
Aplasias and malformations
Degenerative diseases

Secondary to destructive lesions caused by

Traumata
Hemorrhage
Infections
Toxic agents
Anoxemia
Irradiation

Mixed types

Combined *primary* and *secondary*
Combined *primary* and *symptomatic*

II. *Deviated Development*

Symptomatic retardations and deformations due to

Prematurity
Endocrine dysfunction
Selective sensory handicaps
Selective motor handicaps
Abnormal experience: deprivation or stress
Personality defects: congenital or acquired
Mixed types: any combination of symptomatic causes

retardation at the age of 24 weeks, and into 1 year of retardation at the age of 2 years, and so forth. In short we are dealing with a ratio rather than with absolutes. For convenience we shall call this ratio the Developmental Quotient or D.Q. The D.Q. is simply the relationship between maturity age and actual age, expressed as a percentage value.

$$D \, Q. = \frac{\text{Maturity Age}}{\text{Chronological Age}} \times 100$$

To illustrate with the example just cited: 4 weeks (maturity age) is 50 per cent of 8 weeks (chronological age). The resultant D.Q. is 50. Likewise 12 weeks is 50 per cent of 24 weeks, and 1 year is 50 per cent of 2 years. The D.Q. is 50. This is consistent retardation; the child as he grows older is achieving only half of his expected growth. *The D.Q. therefore is a shorthand device for expressing the rate of development.*

To illustrate further, a perfectly normal child would maintain a perfectly average rate of development, maturity age and chronological age always being equal and coinciding as follows:

$$\frac{\text{Maturity age}}{\text{Chronological age}} \quad \frac{8 \text{ wks.}}{8 \text{ wks.}} \quad \frac{24 \text{ wks.}}{24 \text{ wks.}} \quad \frac{52 \text{ wks.}}{52 \text{ wks.}} \quad \frac{24 \text{ mos.}}{24 \text{ mos.}} \quad \frac{36 \text{ mos.}}{36 \text{ mos.}} = \text{D.Q. } 100$$

In this series, the ratio between maturity age and chronological age is always unity or 100 per cent. The D.Q. is 100.

If the rate of the child's development were evenly accelerated, the ratio might read as follows:

$$\frac{\text{Maturity age}}{\text{Chronological age}} \quad \frac{12 \text{ wks.}}{8 \text{ wks.}} \quad \frac{36 \text{ wks.}}{24 \text{ wks.}} \quad \frac{18 \text{ mos.}}{12 \text{ mos.}} \quad \frac{36 \text{ mos.}}{24 \text{ mos.}}, \text{ etc.} = \text{D.Q. } 150$$

The ratio in this case is 3:2 or 150 per cent. The D.Q. is 150.*

If, on the contrary, the rate of development were evenly retarded, the ratio might read as follows:

$$\frac{\text{Maturity age}}{\text{Chronological age}} \quad \frac{8 \text{ wks.}}{12 \text{ wks.}} \quad \frac{24 \text{ wks.}}{36 \text{ wks.}} \quad \frac{12 \text{ mos.}}{18 \text{ mos.}} \quad \frac{24 \text{ mos.}}{36 \text{ mos.}}, \text{ etc.} = \text{D.Q. } 67$$

In this series, the relationship is 2:3. The percentage value is 66 2/3. The D.Q. is 67.

The D.Q. thus represents the proportion of normal development that is present at any given age. When the development is consistent,

* The problem of acceleration in infancy is discussed in Chapter xvi, pp. 310 ff.

the D.Q. predicts the proportion of normal development that will take place in the future. The D.Q. accordingly has considerable orientational value in clinical practice. It furnishes *a rough index of the current rate of development*. In uncomplicated cases we assume that this rate will remain more or less constant throughout the whole cycle of behavior growth. Whenever. the Developmental Quotient falls decisively below the two-thirds or three-fourths ratio (D.Q. 65-75) there is reason to suspect serious retardation. The retardation may be permanent; it may not be consequential if it is limited to certain areas of behavior. But it is a clinical indication which calls for further study. It helps to define the issues which need interpretation.

The D.Q. is the beginning and not the end of developmental diagnosis. It serves as a point of departure. It must not be over-simplified or over-stretched. In careful developmental appraisal it is necessary to make a separate maturity age rating for each of the four fields of behavior; and to determine individual D.Q.'s for motor, adaptive, language, and personal-social development. Only when the maturity in the several fields is at nearly the same level, is it permissible to assign a single inclusive maturity level and a general D.Q.

D.Q. and I.Q.

A word is here in order concerning the ubiquitous and somewhat over-publicized I.Q. or Intelligence Quotient. Although the principle which underlies the D.Q. is similar to that of the I.Q., there are important differences in clinical application which should be pointed out.

Historically the I.Q. traces back to the work of Alfred Binet who drew up a measuring scale of intelligence based upon age norms. The ratings on this scale are expressed in terms of mental age— mental age being equivalent to intelligence age. Stern and Terman converted this mental age into an intelligence quotient by establishing a ratio with chronological age, similar to the ratio between maturity age and chronological age.

The I.Q. does not directly measure intelligence in any absolute way; it signifies rather the relative rate at which so-called intelligence is developing on the basis of a standardized psychometric scale which consists largely of verbal and problem solving tests. The tests are scored on an arbitrary basis of success and failure.

The successes, irrespective of their distribution, are added. The sum is the mental age. From the standpoint of diagnosis this is an obvious over-simplification. It leads to the fallacy of regarding intelligence as a global entity, and it does not differentiate individual types of intelligence, intellectuality and giftedness.

The Binet intelligence scale has been chiefly applied to children of school age. A widely accepted classification subdivides the grades of subnormal intelligence on an I.Q. basis as follows: Idiocy, I.Q. 0 to 20; Imbecility, I.Q. 20 to 50; Moronism, I.Q. 50 to 70. This is an arbitrary psychometric classification. It has descriptive and statistical value, but it leads to serious errors if not used with caution in clinical situations. An I.Q. cannot automatically deliver a diagnosis. It admittedly needs qualification and interpretation.

As already noted in Chapter I, developmental diagnosis does not attempt a direct measurement of intelligence as such, but should aim at clinical estimates of mentality based upon an analysis of maturity status. We are interested in the biological equivalents of intelligence which we have called adaptive behavior; namely, the capacity to use and to initiate experience for present and for future adjustments. The infant, however, is so integrated and generalized that this adaptivity must always be considered in relation to the other aspects of behavior,—motor, language, and personal-social. Developmental diagnosis is consistently concerned with maturity status rather than with abilities as such.

The D.Q., unlike the I.Q., is not limited to a single inclusive formula. A distinctive D.Q. can be derived for each of the four major fields of behavior; for specific functions like prehension, locomotion, manipulation, etc. This makes the D.Q. an adaptable device. The D.Q. registers changes in the growing complex of behavior. Fluctuations in a general D.Q. or in specific D.Q.'s denote intrinsic and extraneous factors which are subjected to interpretation. In clinical hands, the D.Q. is an analytic tool, a diagnostic indicator, which consistently limits itself to the problem of maturity status. It is based on a determination of developmental level and can be discriminatively applied to specific aspects and fields of behavior. It does not attempt to quantify an all-inclusive function in a single formula.

The single formula concept is inadmissible in the diagnosis of infant behavior. A single summative numerical value cannot do justice to the complexity and variability of infant development. Any adaption of our tests and methods which, for psychometric convenience

would affix I.Q.'s to infants is undesirable, and is inadequate for the scientific study of growth processes.

Errors of clinical application will be avoided if we remember that the D.Q. refers to the end-products of development. It does not in itself take account of the etiologies of defects and deviations, the medical history of the child, environmental and experiential factors, personality liabilities and assets. The diagnostician therefore must weigh all these qualifying considerations and interpret the D.Q. accordingly. He must ultimately determine whether a given D.Q., general or specific, is really predictive or whether deflecting factors are present. Fluctuations in D.Q. over a range of 10 points may be entirely benign, and may be due in part to the imperfection of our measuring device. In a word, the D.Q. must be taken with the proverbial grain of salt. But it is infinitely more useful in the problems of diagnosis than salt alone. It takes the estimate of developmental status out of the realm of subjective impressionism.

The Developmental Quotient has an additional merit. It reminds the examiner that, contrary to popular view, the younger the child, the more serious is the prognostic significance of every degree of true retardation. Two months is to 3 months as 2 years is to 3 years, and also as 6 years is to 9 years—which, in terms of D.Q., is another way of saying that 1 month of retardation in infancy may be the equivalent of a whole year, or even of 3 years in later childhood. Retardation, like a shadow, lengthens with the lapse of time.

This makes the determination of short shadows significant for the developmental diagnosis of infants. A month counts heavily in the calendar of development in infancy. Indeed, a constitutional retardation of only one month at the chronological age of 2 months may well signify mental deficiency.

In the following chapters we shall consider various environmental and intercurrent factors which may depress or deflect the course of child development. In certain somewhat extreme instances, the trend of development can be elevated by improved environmental conditions. In other selected instances therapeutic tests, endocrine and otherwise, may be resorted to. The D.Q. then becomes a valuable aid in determining the efficacy of the therapeutic measures.

whether they are directed to the endocrine system, nutrition, sight, hearing, or social readjustments in the life situation.

The more complicated problems of differential diagnosis cannot always be solved on the basis of a single examination. Several examinations at spaced intervals may be necessary to define a critical judgment of the rate and course of development. Differential diagnosis then becomes a program of orderly investigation combined with supervision. It entails identification, exclusion, and progressive evaluation.

CHAPTER VI

AMENTIA AND RETARDATION

In the previous chapter we have shown that an understanding of the developmental aspects of mental deficiency is fundamental to differential diagnosis. In all cases of defective and deviated development, one must first inquire whether the consequent retardations and deformations of behavior are deep-seated or transient, generalized or delimited, ameliorable or irreducible. In a word, we must recognize or rule out amentia.

Amentia is a protean condition as varied in its clinical manifestations as insanity. Classical textbook types occur, but individual variation is the rule. Many cases escape recognition in infancy because the undiscriminating eye fails to make critical distinctions between different degrees of immaturity. Contrariwise, partial disabilities often simulate mental deficiency. It then becomes important to detect the normal potentialities which are masked by the misleading visible defects.

There are many degrees and modes of developmental retardation. In this chapter we shall consider especially those permanent forms of retardation which constitute amentia. Amentia literally means, without mind, but the term is used to cover all grades of mental deficiency. It is also synonymous with feeblemindedness and with the less frequent term oligophrenia. Amentia must be distinguished from dementia, a condition of deteriorated mental disorganization which occurs after a previously normal or retarded course of development. In the feebleminded, dementia may occur even during childhood or adolescence. Dementia is an abnormal intercurrent deterioration of functioning, whereas amentia is a basic curtailment of development.

§ 1. Biological and Social Criteria of Amentia

Amentia is based on developmental deficiency. It represents either a reduction or an impairment of growth potentialities. As a consequence, the *rate* of maturing is *retarded*, and the ultimate *level* of behavior is *lowered*.

Infants vary enormously with respect to their growth capacities. These capacities depend first of all upon biological inheritance. The normal individual, by virtue of healthy genes, has an inborn power to adjust to his environment and to profit by experience. He is able to meet the normal expectations of development as embryo, fetus, infant, child, and adolescent. He is able to mature. As an adult, also, he meets the normal requirements of family and community life. He manages himself and his affairs with some efficiency. He "gets along," primarily because he has the requisite biological equipment.

If his biological equipment is superior, he goes further and deeper than his fellows. Even as an infant he may display exceptional vitality and promise in the manner in which he meets the demands of his environment.

If his original equipment is inferior, if it becomes damaged *in utero*, if it is blemished during birth, or if it is impaired by accident or disease after birth, he cannot adequately meet the demands of his environment even in infancy. His development may be completely arrested or seriously diminished. It may be diminished to such a degree that the child when adult will continue to require extraordinary supervision and support. *From the standpoint of the law, a mentally deficient person is one who will always require special supervision or external control for his own and the social welfare.*

Developmental diagnosis should not ignore this social and medicolegal criterion. Every diagnosis of mental deficiency in a child carries the prognostic implication that this child when he becomes an adult will not be able to manage himself and his affairs with ordinary prudence. He will always show a lack of intelligence and independence in the struggle for existence.

This is a biological lack which displays itself early and nowhere more strikingly than in the field of behavior. The low grade ament is slow even in learning to hold up his head and to co-ordinate eyes and hands. The ament of middle grade can learn only a few routine

tasks and the simplest forms of self-care. The ament of higher grade cannot profit from ordinary school instruction.

The foregoing grades of mental deficiency roughly correspond to the three basic clinical categories: *idiot, imbecile,* and *moron.*

An *idiot* is so deeply defective that he is incapable of guarding himself against ordinary physical dangers. His general behavior capacities when mature are less than those of an average 3-year-old child.

An *imbecile,* when adult, guards himself against simple physical dangers but is unable to manage his daily affairs and needs almost constant supervision. His behavior capacities range roughly from the 3-year to the 7-year level.   .

The behavior capacities of the adult *moron* range from the 7-year to the 11-year level. The moron cannot meet the ordinary demands of family, school and community life. He always needs some degree of supervision and guidance. At the higher levels he may be self-supporting but only under unusually favorable circumstances.

In terms of vocational capacity the following distinctions can be made: the idiot is vocationally incompetent or helpless; the imbecile is vocationally dependent and needs constant supervision; the moron is partially independent vocationally but needs protective oversight. It is impossible to establish a sharp cleavage between the various categories. One category merges into another and theoretically we may say that the higher grades of mental deficiency shade into the dull-normal zone. Practically, however, it is well to make a clear-cut distinction between certifiable mental deficiency and normality.

A moron is not a mere dullard. A dullard is normal in the sense that he has enough mother wit to get along on his own in the struggle for existence. Mere inferiority of intelligence does not constitute mental deficiency if the individual shows no marked social incapacity. Personality factors also must be taken into account and often they are of more importance than intellectual ability. The diagnosis of mental deficiency therefore should be reserved for those individuals who will need external support and supervision because of inferiority in behavior capacity.

§ 2. Trends of Defective Development

As an introduction to the clinical manifestations of amentia we append (p. 122) a comparative chart of the broad trends of

normal and defective development. The chart includes the first three years of life, the period which is still most neglected from the standpoint of the timely diagnosis of developmental defects and deviations. Six major clinical types are illustrated: Normal, Moron, Imbecile, Imbecile-Idiot, Idiot, Low grade Idiot.

Schematically the chart first shows the *normal* infant of 28 weeks with normal behavior equipment and performance. At 3 years he still is normal; he has progressed enormously; his mental growth rate as measured by D.Q. is 100.

The *moron* at 28 weeks is functioning at about a 16 week level; this represents an absolute retardation of only 12 or 14 weeks, but in terms of D.Q. it denotes a reduced growth rate of 50 to 60. At 3 years this same moron will be functioning between an 18-month and a 2-year level (D.Q. 50-60).

When the retardation is still more severe, the defective of 28 weeks is functioning at the lower level represented by the maturity zone of 8 to 12 weeks, with a D.Q. or growth rate of 30 or 40. At this early age he may be provisionally classified as an *imbecile-idiot,* because the growth rate of 30 may signify either imbecility or idiocy at the age of 3 years. Deceleration is a frequent phenomenon. Consequently at 3 years the imbecile-idiot may prove to be an imbecile functioning slightly below the 1-year level; or a true idiot functioning near the 16-week level. Sometimes even the infant moron when he attains the age of 3 or more years may be finally diagnosed as an idiot or as an imbecile. The *profound idiot* functions at a neonatal level at the age of 28 weeks, and makes scarcely any advance over three years of time.

All forms of amentia may be interpreted in terms of more or less general retardation. Certain adverse conditions, however, produce selective and symptomatic retardations which result in restricted disabilities and uneven trends of growth. Consideration of such conditions, both inborn and acquired, is deferred to Chapters XII-XVII. Differential diagnosis of irregular and atypical deviations, however, requires by way of background a knowledge of the clinical characteristics of the different degrees of amentia and of their underlying trends of development. Familiarity with these characteristics is the first essential in diagnostic orientation.

COMPARATIVE DEVELOPMENT
NORMAL, MORON, IMBECILE, AND IDIOT BEHAVIOR
AT 28 WEEKS AND 3 YEARS OF AGE

28 WEEKS

	Maturity Level
MOTOR BEHAVIOR	
Normal: sits alone, leaning on hands, head erect...	28 wk.
Moron: sits supported, head steady but set forward.	12–16 wk.
Imbecile-Idiot: sits supported, head unsteady......	8–12 wk.
Low grade Idiot: head droops......	0–4 wk.
ADAPTIVE BEHAVIOR	
Normal: reaches, grasps, transfers......	28 wk.
Moron: does not reach; regards object in hand....	12–16 wk.
Imbecile-Idiot: disregards or only glances at object in hand......	8–12 wk.
Low grade Idiot: stares vacantly; may hold object reflexly without regard......	0–4 wk.
LANGUAGE BEHAVIOR	
Normal: vocalizes m-m-m......	28 wk.
Moron: chuckles or laughs aloud......	12–16 wk.
Imbecile-Idiot: smiles; feeble vowel sounds......	8–12 wk.
Low grade Idiot: vague throaty sounds......	0–4 wk.
PERSONAL-SOCIAL BEHAVIOR	
Normal: takes solids well......	28 wk.
Moron: chokes on solids; anticipates feeding......	12–16 wk.
Imbecile-Idiot: watches moving person......	8 wk.
Low grade Idiot: stares blankly at persons......	0–4 wk.

3 YEARS

	Maturity Level
MOTOR BEHAVIOR	
Normal: climbs stairs with alternating steps......	3 years
Moron: walks......	18–24 mo.
Imbecile: stands......	40–52 wk.
Idiot: sits supported, head steady or wobbly......	12–16 wk.
Low grade Idiot: lifts head in prone......	0–4 wk.
ADAPTIVE BEHAVIOR	
Normal: builds bridge from model......	3 years
Moron: builds tower of 2–3 cubes......	18–24 mo.
Imbecile: dangles ring by string......	40–52 wk.
Idiot: grasps object near hand or on contact......	16 wk.
Low grade Idiot: stares vacantly; drops object in hand	0–4 wk.
LANGUAGE BEHAVIOR	
Normal: speaks in sentences, using plurals and prepositions......	3 years
Moron: names a few pictures......	18–24 mo.
Imbecile: says mama......	40–52 wk.
Idiot: laughs......	16 wk.
Low grade Idiot: crying and vague ejaculation......	0–4 wk.
PERSONAL-SOCIAL BEHAVIOR	
Normal: feeds self, little spilling......	3 years
Moron: carries and hugs doll......	18 mo.
Imbecile: offers toy to mother......	40–52 wk.
Idiot: anticipates feeding; smiles on social approach	16 wk.
Low grade Idiot: stares blankly at persons......	0–4 wk.

The differential diagnosis of developmental status therefore begins in general with a broad provisional distinction between the following types of mental growth.

(1) Normal (a) with even course of development; (b) with benign irregularities; (c) with acceleration.

(2) Moron (a) with consistent and relatively uniform retardation; (b) with deceleration to imbecile or idiot levels.

(3) Imbecile-Idiot (a) with consistent trend at imbecile level; (b) with deceleration toward idiot level.

(4) Idiot (a) with consistent trend at idiot level; (b) with deceleration.

(5) Selective defects and deviations.

CHAPTER VII

AMENTIA OF HIGH GRADE

Compared with the ament of low grade, the moron develops at a relatively rapid rate. Indeed, in some instances the retardation of the moron during infancy may be so mild as to escape attention. Lacking pronounced physical stigmata he may present a plausible picture. It is, of course, well known that even an adult moron sometimes passes for normal in the absence of an adequate diagnosis. An infant moron may be capable of adaptive eye movements, may stare with apparent attention, may smile. According to report, "He is no trouble at all; he is a good baby." Perhaps too good; there may be some disquietude because of the lack of vigor in his behavior, but it is optimistically assumed that as he grows older he will be different. The optimism is not warranted. A series of examinations will fail to show any trend toward improvement. It is a very exceptional case of mental deficiency which cannot be diagnosed in the first year of life.

Typical is the case of K. R. whom we examined at 8 weeks, 32 weeks, 1 year, and 5½ years. An outline of the biography of his development may serve as a frame of reference for an understanding of the high grades of mental deficiency. In the following pages we propose to follow the course of his mental growth.

§1. A MORON INFANT

I. The first examination was made when K. R. was *8 weeks old* The *motor symptoms* at 8 weeks are not immediately reassuring even though the infant's supine posture approximates a normal t-n-r attitude. His head lags completely on tentative elevation, sags when he is held in the sitting position, droops in ventral suspension. In the prone position he lifts his head momentarily to Zone I.

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In early infancy the head is a very important area for observation, because development moves in a cephalo-caudad direction, and in an 8 weeks old baby we wish to see evidence of organizing head control. The average, normal 8 weeks infant holds his head bobbingly erect. Lowered to prone he erects his head while in ventral suspension; and having been placed prone, he turns it to midposition and rears it to Zone II recurrently.

To sum up, here is an 8 weeks old infant who in *motor behavior* is functioning little better than a 4 weeks old infant. This represents only four weeks of retardation,—a negligible amount, unless it signifies a permanent lag; at 8 weeks a lag of 4 weeks creates a ratio of 4 to 8, a D.Q. of 50.

Adaptive behavior likewise falls below expectation. K. R.'s facial expression shows no attentional responses, and no visual fixation can be elicited. He does not regard the ring dangled in his field of vision but there are slight eye movements as the rattle is shaken and moved. (This response rules out blindness.) There is no response to the bell. Whether this is due to deafness is not yet clear. *Language behavior* is very meager. No throaty sounds are heard. His facial expression is quite bland and impassive. In the *personal-social* field he shows no regard for the examiner's face on social approach. He stares indefinitely at surroundings. By the mother's report he is said to follow a moving person and to stare at a window. Perhaps this testimony may be credited because the mother does not report either social smiling or facial brightening.

It will be recalled that the normative 8 weeks old infant gives delayed regard to a dangling ring in the midline, that he follows the ring past the midline, that he shows some facial animation on hearing a bell, that he regards the examiner's face, that he shows an alert expression from time to time, and smiles socially. He is also capable of making vowel sounds like *ah* and *eh*.

On all these counts it is clear that K. R. is retarded not only in the motor field but in all associated fields of behavior. This means that the motor retardation evidenced in defective head control has ominous import. He is chronologically 8 weeks old; his present maturity level is in the neighborhood of 4 weeks. A provisional diagnosis of mental deficiency is made. His developmental status is plotted on the record as follows:

Name: *K. R.* Age: *8 weeks*	Developmental Key Age		
	0	*4 weeks*	*8*
Motor		√	
Adaptive		√	
Language		√	
Personal-Social		√ ---- √	
Hearing		?	
General Outlook	*Probably Defective*		

II. K. R. is *32 weeks* of age on the second examination. We are pleased to note on first glance that the facial expression is somewhat more alert and the regard more direct. The mother reports that he is able to sit up in a propped position for over an hour. We are therefore warranted in beginning the examination by placing the child in the examining chair. This represents a postural gain, but the significance of the gain will not become apparent until we have made a careful survey of the patterns of behavior in the four major fields.

Motor behavior. Motor gains are registered in increased head control. The baby no longer shows head lag and in the supine position keeps the head predominantly in the midposition. This indicates a 16 to 20 weeks level of maturity in head control. The arms and hands likewise show an advance in patterned behavior. Supine, the hands now engage at the midline. Prehensory grasp is sufficiently advanced to result in retention of the dangling ring. The cube also is precariously held. He scratches the test table,—another indication that the prehensory patterns are undergoing development. The last named pattern approximates a 20 weeks level of maturity; the general postural behaviors, supine and prone, are near the 16 weeks level.

Adaptive behavior tends to gravitate toward the 12 to 16 weeks level. The baby looks down at his hands. He gives immediate regard to the ring. He also regards the rattle in hand and he brings the free hand up to the dangling ring. These are considerable gains when

compared with the profound ineffectuality of his eye-hand behavior at the age of 8 weeks.

Language and personal-social behavior. He laughs aloud, gurgles, and coos in his vocal play. He smiles spontaneously in social situations; he vocalizes by way of social response. He turns to the sound of a bell, a 24 weeks behavior pattern. With this single exception, his language and social behavior approximate a 16 weeks level.

Since his maturity in the other fields of behavior is at a similar level, it is natural then that 16 weeks should be used as the key age for graphing the maturity status of this 32 weeks old child.

His behavior gains have been notable and consistent. Evidence of hearing is now definitely established. But there has been no acceleration of development. The D.Q.'s in the various fields of behavior are again in the neighborhood of 50. He has advanced from a 4 to a 16 weeks level of maturity, but the relative retardation remains constant. The diagnosis of mental deficiency provisionally made at the age of 8 weeks is confirmed. The outlook is definitely defective.

Name: *K. R.* Age: *32 wks.*			Developmental Key Age		
	8	12	16 wks.	20	24
Motor			√	- - - √	
Adaptive		√ - - - √			
Language			√		
Personal-Social			√	·	
Fine motor			√		
Hearing					X
General Outlook			*Defective*		

III. The third examination of K. R. falls on his first birthday. How has he used this first year of chronologic time when growth normally proceeds at its maximum pace? Has he made up the lag of three or four weeks which was noted when he was 8 weeks old?

The lag has lengthened. At the age of *one year* he sits alone, and even stands when his hands are held; but in the prone position he barely lifts his head. This is an atypical combination of motor abilities and suggests that his general postural and locomotor patterns are undergoing very slow and imperfect organization. Likewise in the field of fine motor control. At one year he should be plucking a pellet with precise finger prehension, but he merely rakes at it with 28 weeks crudity. None of his motor abilities rises much above a 32 weeks level.

The growth of his *adaptive behavior* has scarcely kept pace with his motor development. His attention wanders and is difficult to elicit. (A normal child of one year dominates the examination with eager, restless attention, seizing each new test object avidly, and exploiting two or more at a time.) K. R. grasps but a single object, shows delay in his perception of the object and also in his approach upon it. He does not even transfer it from one hand to the other, a universal propensity in normal infants at 28 weeks. We are obliged to rate his adaptive behavior at a 24 weeks level.

Language behavior earns a similar rating. His vocalization consists chiefly of bubbling, burbling, and sputtering. He locates sounds and turns toward the radio by way of listening.

Personal-social behavior also is at a 24 to 28 weeks level. The care and stimulation he has had from his mother have not perceptibly raised his level. His play interests are limited. He plays repetitively with familiar toys and is "afraid" of new toys. He plays with his feet, trying to put them to the mouth; but still looks occasionally at his own hands, a pattern more appropriate to 16 weeks, and usually fully outgrown by 28 weeks. But a defective child outgrows slowly and incompletely. His behavior patterns contain many archaic residuals.

He cries when you try to teach him patacake. He cannot learn because he scarcely has the motor, adaptive and personal-social equipment of a 28 weeks old child; and patacake needs 40 weeks' maturity. Although he is one year old, the maturities of this child must be graphed on a grid with *28 weeks* as the key age.

The diagnosis is now firmly established. Uncritical optimism might suggest that this child made a good showing in postural control (standing when held by the hands); yet it would be fatuous to

think that he will really make up his arrears in later childhood. He will in a sense outgrow some of them; but new arrears will come into evidence. He will not make up lost time. At the age of one year he has not mastered some of the elementary neuro-motor problems of infancy.

Name: *K. R.* Age: *1 yr.*	Developmental Key Age		
	24	28 wks.	32
Motor			√
Adaptive	√		
Language	√		
Personal-Social	√	√	
Fine motor		√	
General Outlook	*Defective (High Grade)*		

§ 2. A MORON CHILD

To make our developmental story more complete we shall report one more examination of K.R. at the ripe age of *5½ years*, when the normal child is beginning to turn his face toward the elementary school.

When K.R. was one year old his mother rather wistfully wondered whether her backward child was weak in the legs, or in the back, or in the head! It proves that he is feebly endowed in all three subdivisions, for they are alike controlled by a central nervous system with deficient growth potentials.

It took him three years to learn to walk and still longer before he began to put blocks and words together, and learned not to touch "mother's toys." He is almost of school age, but he still must be rated on a pre-kindergarten schedule, with 24 months as the key age. He is an attractive rosy-cheeked boy with occasional flashes of alertness and attention. If we forget his chronological age he

makes an encouraging impression; but for diagnostic purposes we must be mindful of his 5½ years. In our treatment of the boy and our guidance of his parents, however, almost exclusive stress should be placed on his truest and most fundamental age, namely his developmental age.

Name: *K. R.* Age: *5½ yrs.*	Developmental Key Age		
	21	*24 mos.*	*30*
Motor	√		
Adaptive		√	
Language			√
Personal-Social		√	
General Outlook	*High Grade Defective, trainable*		

Let the brief but concrete characterization by the examining physician sum up his present status:

At 5½ years K. is a co-operative, friendly boy. He walks alone, seats himself in a chair, and attempts to kick a ball. He builds a tower of seven cubes, imitates the five-cube train, but not the three-cube bridge. He scribbles vigorously, imitates the vertical stroke and the circle. He places two color forms correctly. He names ten pictures; his articulation is poor but he uses short sentences and knows one or two songs. He does not feed or dress himself, but he asks for the toilet during the day.

His general maturity level is approximately 2½ years. Development is defective but of relatively high grade, and he has been well managed, has thus far presented no difficult problems at home, and is capable of considerable training.

§ 3. A Moron Adult

Past, Present, and Future. The course of mental growth in K.R. is more or less typical of all high grade mental deficiency. We can see that the behavior patterning (which is in fact mental growth)

has been proceeding at a slowed rate throughout infancy and throughout the whole preschool period of childhood. Indeed, looking backward, we may be certain that the retardation·was present even during the fetal period. This child was born with a developmental potential definitely below normal.

Looking forward we can project a similar course of growth. This boy looks attractive, is obedient, and now and then alert, but this is no reason for believing that he will outgrow his present retardation. His nervous system will not develop any new growth potentialities with the eruption of his second teeth, or with the onset of puberty. The older he is the harder it will be for him to develop a definite proportionate amount.

He will continue to develop at his present rate for a dozen years or more. To that extent he will improve. But if we project his future curve of mental growth it will still be at a defective level when he is in his teens.

In spite of the fact that he is a "good boy" and may even learn to write his name and spell out a few words, we have discussed with the parents the advisability of commitment to an institution. K.R. is trainable. If he goes to a training school adapted to his mentality he will be happier and more useful than at home. He likes animals. He could become a worker on the school farm taking care of the cows. In adult years he might even be competent enough to be partly self-sustaining, but only with external support and supervision which the community must supply.

Mental deficiency, therefore, proves to be a social, an educational, and a medical problem. All three aspects are interrelated. But first and foremost it is a medical problem. The doctor must make the early diagnosis and use his strategic position to give constructive oversight and guidance during the growing years. In the present instance the need of oversight began as early as the age of 8 weeks.

§ 4. INFERIOR ENDOWMENT

Infants are unequally endowed with growth potentialities and behavior capacities. For purposes of differential classification the category *inferior* endowment has usefulness and convenience. It comprises those individuals who without being definitely defective, are nevertheless well below average with respect to developmental

status and outlook. Emphasis has been placed on the importance of making a distinction. between dullness and amentia. For practical clinical reasons the diagnosis of mental deficiency is reserved for the child who in adult years will need special supervision. Dullness is not a mild form of mental deficiency in this medicolegal sense. It is a form of normality albeit of low degree and of poor quality.

The clinician must therefore recognize a marginal group of cases which border on amentia without being certifiably feebleminded. This is a highly diversified category which should not, however, be made into a catch-all. Three types of cases may be distinguished: (a) borderline dull, (b) borderline unstable, (c) borderline defective.

Borderline dull denotes a mild degree of retardation and a general reduction of performance, particularly in the fields of language and adaptive behavior. The reactions are slow, limited, and very mediocre, without, however, being seriously inadequate. In quality the behavior is relatively normal.

Borderline unstable denotes a similar inferiority combined with impulsive, highly changeable and other atypical emotional reactions. In quality the behavior is more or less abnormal.

Borderline defective denotes a degree and form of inferiority which approximates high grade amentia. The behavior is relatively well organized and balanced. In quality and caliber it is defective but not sufficiently so to warrant a diagnosis of frank amentia. When an underlying defect is combined with instability the condition may be designated as *borderline defective-unstable.*

If we imagine a distinguishing diagnostic line separating the normal from the defective, a borderline *dull* would be on the favorable side of this line, a borderline *defective* on the unfavorable, a borderline *unstable* might be on either or both sides with instability of emotional organization a dominant trait.

The foregoing distinctions must rest on clinical impressions rather than on precise objective criteria. They are useful as descriptive diagnoses. A borderline classification is far better than a poorly supported diagnosis of mental deficiency.

CASE 1 made a poor showing on the developmental schedules, but was diagnosed as *borderline dull* rather than defective. He was referred to

the clinic at the age of *two years* because he was slow in talking. He did not respond to simple questions; his sole vocalization was "uh" when the picture card was presented. He did not scribble imitatively, but simply turned the crayon end over end, and tapped it on the paper. He built a tower of four blocks, but not a train. He inserted the rod into the performance box but not the block. In sum, his adaptive performance was at 18 months rather than 24 months, with a D.Q. of approximately 75.

This degree of retardation is serious enough to suggest mental deficiency, but there were mitigating factors. In spite of the slowness of the boy's reactions and his unprepossessing appearance, the general tenor of his responses was normal. His word comprehension was in advance of his speech. He adjusted fairly promptly to the rotation of the formboard. He was co-operative as well as docile during the examination. Although he had not been weaned from bottle to cup, this was due to mismanagement at home. His parents by report were not over-intelligent, which is a roundabout way of saying that they were dull rather than feebleminded. Case 1 is carrying on the tradition. A diagnosis of mental deficiency is not warranted. We classify him as borderline dull.

A *borderline unstable* child displays unsteadiness and exaggerations in his emotional reactions, and atypical deviations in one or more fields of behavior. His patterns of attention may be unusual and are sometimes positively eccentric because of their stereotypy or compulsiveness. He may be active and give an appearance of alertness which is superficially deceiving. His approximations to normality are fragmentary. Discrepancies and disparities become apparent when his maturity is separately evaluated for the several fields of behavior.

Take for example CASE 2. He was referred for examination because of his peculiar gait. At the age of *20 months* it is reported that he is overactive, afraid of men, not interested in toys but fond of dogs! He goes about touching objects in a gingerly manner, and even avoids bringing food to his mouth.

He is rather attractive in appearance; but detached and preoccupied in his attitudes. The rapport between himself and the examiner was shallow and variable. He exhibited a recurrent fearsomeness. He could not be reassured by his mother, but he was calmed and comforted by snuggling a soft woolen sweater. During the period of initial adjustment he played alternately with the picture book and the sweater. He became engrossed with the cup and cubes and played with them for ten minutes

in an infantile perseverative and stereotyped manner. He brought his mouth to the cup and blew into it repeatedly and indulged in swishing tongue movements. He would have continued with this play for an indefinite period if left to his own devices. Surprisingly enough, well defined bits of normal behavior could be elicited both at the 15 months and 18 months levels. (He scribbled vigorously, named the picture of the dog, and carried out two simple commands with the ball.) These bits of behavior, his jargon, and a vocabulary of some 15 words were sufficient to suggest a child of inferior rather than definitely defective endowment. His peculiar wide-based prancing gait, the hyperextension of fingers, arms and legs, and the faulty co-ordination were suggestive of a diffuse neurological defect. These motor characteristics, a history of psychopathy in the immediate ancestry, the uneven and partial nature of the retardation and the stereotypy of behavior justify a diagnosis of borderline unstable.

CASE 3 at the tender age of 17 months was referred to us with an unflattering reputation. She was described as "stubborn, backward, slow, very jealous, craves unusual amount of attention; conduct peculiar. Screams at about five o'clock and refuses to eat supper; moans in bed; wakes at night with weird cries; clings to bottle; refuses cup. Mother mentally inferior and erratic; father alcoholic."

Examination revealed a strange little girl, a mixture of smiles, self-possession, extreme inhibition, sustained attention, stereotyped reactions, greatly reduced postural activity. Maturity levels ranged from 13 to 15 months. She was diagnosed as borderline unstable.

At the age of 2 years her general level of maturity had risen to approximately 18 months. The foster mother had been advised to relax her severe disciplinary measures and over-strenuous toilet training. Although tantrums continued, the child's emotional deportment greatly improved with the revised management. Her behavior was more integrated although it remained at an inferior level. If her personality improvement continues she may ultimately be classified as borderline defective.

CASE 4 was reputedly normal to the age of 13 months except for failure to vocalize. When examined at 15 months he showed no interest in the test objects and stared vacantly at the ceiling or at his own hand. He pulled himself to a standing position in the crib and rocked back and forth incessantly for prolonged intervals. He had other stereotyped mannerisms which were perhaps attributable to long institutionalization. At 20 months his behavior was still more bizarre including studious disregard of persons, startled withdrawal from toys, abrupt assumption of a

salute attitude with head retracted to gaze at the ceiling, marginal sensitiveness to slight movements of the examiner. At *24 months* the same general demeanor and peculiar behavior traits persisted with only a slight increment in behavior maturity (builds tower of two, imitates stroke, climbs into chair, holds own glass to drink).

At *3 years* the mannerisms still persisted (rocking back and forth, tilting the head to stare at the ceiling, avoidance of gaze). At this time he walked well, went up and down stairs unassisted, built a tower of five cubes, imitated a stroke, differentiating between a stroke and circular scribble, placed the round and square blocks in the formboard. He articulated one word but did not identify pictures nor carry out differential commands. On the basis of this examination and the developmental history, he was assigned a maturity level of approximately 21 months and classified as borderline defective. The outlook for amelioration did not appear very hopeful.

At *4 years* his behavior was more normal in quality even though attention was poorly sustained. He built a tower of 8 cubes, arranged the cubes in a symmetric mass, imitated bridge and gate; he partially imitated the drawing of a cross and was credited with the articulation of only three words. His failure to carry out differential commands seemed to be due to faulty attention. The clinical picture still presented many irregularities but descriptively a general maturity level of 30 months was assignable.

At the age of *5 years* he displayed fragments of ability which suggested 3 years' capacity but he was hyperactive, over-precipitate in responses. His spontaneous cube constructions showed a normal sense of pattern. But his vocal language was scarcely at an 18 months' level and his attentional patterns remained highly atypical. They were so atypical that instability as well as defectiveness of adaptive behavior was indicated. The descriptive diagnosis is *borderline defective-unstable*.

CASE 5 presents an interesting contrast by virtue of her attractive personality. But we classify her as a borderline defective, because since infancy her mental growth has been consistently retarded at a subnormal or borderline level. We have followed her development over a period of 15 years.

She first came to our attention at the age of *40 weeks* as an orphan who was considered for adoption. She had every appearance of being an entirely normal infant in countenance, in responsiveness, and general reactiveness. Indeed her amiable personality cast a spell which tended

to conceal her fundamental limitations which were revealed by the developmental examination. She rated coherently at 28 weeks level.

Her intelligence rating during ten years at school has shown a similar retardation. At *9½ years* of age her reading and spelling were below the second grade level of performance. At *15 years* of age her reading and spelling are near the fourth grade level.

The personality picture has scarcely changed at all during the long period of developmental observation. The mental growth trend and temperamental traits have remained remarkably constant in spite of checkered environmental changes in institutions and in a succession of foster homes. As an infant she was amiable and amenable. As an adolescent she reveals the same traits. The somewhat inferior quality of her intelligence and judgment make it necessary to provide good supervision and training through adolescence. If she is adequately protected, there is an excellent prospect of her making a satisfactory social and vocational adjustment in adult life. She is near the borderline of amentia but the total behavior picture calls for a diagnosis of *borderline defective*.

§ 5. PSEUDO-SYMPTOMATIC RETARDATION

In a later chapter it will be shown that unfavorable institutional or home environments may have a depressive effect upon the course of development and particularly upon the output of behavior. The seriousness of the effects varies with the gravity of the environmental factors, the personality make-up of the child, and the immunity of his nervous system. The behavior capacities are not fundamentally impaired; readjustments and improvements take place when the environment becomes more favorable; even under environmental stress the behavior usually displays characteristics suggestive of approximate or potential normality. Clinically we characterize this as symptomatic environmental retardation. It is symptomatic because it is the immediate expression of causative factors operating at the time of diagnosis. There is a type of retardation which is falsely ascribed to such causative factors, but which is in reality a true amentia of primary or of secondary origin. Because of the erroneous interpretation which this symptom complex so often attracts, we use the designation *pseudo-symptomatic*.

The fact that behavior development is subject to at least temporary environmental depression is known both to the laity and to the profession. Very naturally, therefore, parents of defective children

eagerly look for extrinsic causes which might account for the ob-
served retardation. The parents wishfully hope that these causes
operate as an obstruction which can be removed by treatment or
which will spontaneously disappear and release the impeded po-
tentialities of development. In relating the history of the case the
parents usually adduce some plausible causative factor such as long
hospitalization, forcible feeding, severe eczema with prolonged
restraint, a dominating nurse, an illness or trauma, etc.

In recounting the history of the case the parents add extenuating
claims: "He does some things so well." "He understands so much."
"It is as though he were thwarted and as though something were
holding him back." "He has an excellent disposition." "He has more
abilities than he likes to use." "One time he said a sentence very
plainly." "He seems unhappy."

In these cases there are residues of behavior, of demeanor, and
of attention which resemble the normal so much as to lend a cer-
tain plausibility to the interpretation which the parents themselves
advance. Often the behavior of the child is very bizarre and paradox-
ically enough the very strangeness of the behavior invites a diag-
nosis which may overlook the underlying amentia. When the be-
havior assumes bizarre patterns there is a temptation to look for
environmental origins and to place a psychiatric construction on
the symptoms. For example, the child may show extreme fixations
on one toy, or on one pastime such as pouring sand through a pipe,
opening and closing doors. This particular behavior becomes a mis-
leading focus of attention in the interpretation of the case. The
behavior may even be invested with symbolic significance to the
relative neglect of a multitude of symptoms which definitely point
to fundamental amentia.

Extreme stereotypies of behavior are a frequent characteristic
in this group of cases. The stereotypy is in the nature of a cauli-
flowering overgrowth. There may be an excessive amount of rocking,
or mouthing, of jargoning, of chewing, clicking, respiratory, and
other mannerisms. Mutism, negativism, seclusiveness figure in dif-
ferent syndromes. The negativism may express itself in heedlessness
to sound or obliviousness to persons. It is frequently found in asso-
ciation with hyperactivity. If the child were apathetic his oblivious-
ness might be more readily recognized as a form of inattention char-

acteristic of amentia. But the activity and the bizarre exaggeration are frequently associated with an attractive countenance and a faraway, wistful expression which builds up an impression of dormant or obscured normality. There is a certain abstractedness in the demeanor which is suggestive of unreleased potentialities.

If the physician yields uncritically to this impression he may describe the condition as one of symptomatic retardation. The parents are encouraged to believe that the child will find himself in time. A special course of training is resorted to, an intensive and expensive psycho-therapeutic program is inaugurated. Parents go to heroic lengths to re-educate the child and to remove the obstructions which they believe are retarding or deflecting the child's development.

Our case histories show that the parents of these children do a great deal of "shopping around." They try one expedient or one program after another. Meanwhile the child is growing older and in retrospect it proves that the retardation was fundamental. Most of the case histories suggest an obscure encephalitis as the etiological factor which accounts for the eccentricities of the behavior picture. But the retardation is inherent in the damaged nervous system; it is organic and not symptomatic. In view of the misleading appearances it is properly described as pseudo-symptomatic. The retardation is not due to "emotional blocking" nor to "environmental impediment" but is based upon a true amentia of primary or secondary variety. In degree, the mental deficiency may be of either high or low grade.

In Chapter xvii we shall consider in more detail the symptoms and the syndromes which characterize true environmental retardation. Familiarity with these syndromes will assist in making a differential diagnosis between the true cases of environmental retardation and the fictitious cases. A well conceived therapeutic test which alters the environment may be necessary to establish this diagnostic distinction. The failure to make a timely differential diagnosis creates unnecessary difficulties for the child and multiplies the disappointments for the parents.

CASE 1 was physically a beautiful, appealing child. She sat alone at 7 *months*. At 10 months she had convulsions followed by possible encephalitis. Examination at 33 *months* revealed a developmental level of 18 months. The parents felt that some emotional block was at the basis

of the retardation and absence of speech, and had provided a special speech tutor who insisted that the child was "bright but highly negative."

The apparent obliviousness to persons fostered continuance of the theory that emotional inhibitions were operating. Excessive training zeal set up tensions and "nervous habits" in the child. These abated when more attention was paid to physical well-being instead of speech instruction.

Re-examination at *4 years* showed an extremely slight advance in all four fields of behavior.

The parents were advised as follows: "If you can bring yourself to shaping your child's world to her needs and can do it cheerfully for her sake, your own distress will be reduced. If there is a remote chance that a change will occur, you will be increasing that chance more by these means than by constantly sustained efforts to teach her beyond her capacity to learn." `

Not until two years later was the diagnosis of amentia accepted. From the parents' point of view the condition had been persistently regarded as one of symptomatic retardation. Actually it was pseudo-symptomatic retardation.

CASE 2, a small, wiry, active child, was examined at the age of *42 months.* Like Case 1 he was completely oblivious of persons; but displayed flashes of attention, such as brief interest in a picture book. The mother firmly believed that ` except for inattention to words, he is like a normal child."

The parents concentrated their solicitude on the heedlessness to the spoken word and the failure to talk. They wondered whether it was due to deafness, aphasia, endocrine disorder, or possibly retardation. Their preoccupation with language factors threw the whole behavior picture out of focus for the parents, and they under-estimated the seriousness of associated behavior, which included rather aimless running and vocalizing, snatches of hand regard, tongue sucking, clicking, rubbing of the abdomen, blowing, etc. This boy did not walk until the age of 27 months, but this was attributed (by the parents) to feeding difficulties. There was a history of vomiting, forced feeding, and slow weight gains. It was suggested (again by the parents) that the forcible feeding methods had set up an emotional blocking.

A series of physical examinations had resulted in conflicting diagnoses as to deafness and endocrine disorder. We ruled out both of these complications and then considered a third possibility, namely "a profound emotional blocking."

This too was ruled out on the grounds that the observed emotional behavior was consistent only with a pervasive retardation affecting all fields of behavior. Emotional factors could scarcely account for the fact that this child did not walk until the age of 27 months. Birth and neonatal histories were normal; there were no evidences of cerebral birth injury. By exclusion, a diagnosis of congenital mental deficiency was indicated,—true amentia rather than symptomatic retardation.

The prognosis? He has learned to walk, he will in time learn to talk a little. Any progress he makes will be exceedingly slow, a matter of years. There will be no revolutionary emotional release or reorientation at adolescence. School, in the ordinary sense, will be quite beyond him. Institutional care was recommended for this boy, for his own good and for the mental welfare of his parents. They finally accepted this diagnosis, but only after a vast amount of miscarried effort and hope, much of which might have been spared. The cases of *pseudo-symptomatic retardation* have a way of making undue trouble for all concerned.

CHAPTER VIII

LOW GRADE AMENTIA

Having given examples of the course of mental growth in milder forms of mental deficiency, we turn now to the graver degrees of defect which also declare themselves in infancy. In terms of mental age, a moron might be described as a defective who mentally never enters his teens and whose intelligence is usually arrested at a level somewhere between 7 and 11 years. Occasionally his mental age may be as high as 12 years or more, but he lacks the social adaptation necessary to fend for himself.

The adult imbecile, as already noted, reaches a mental maturity of from 3 to 7 years. The idiot ranges from near zero to 3 years. In terms of developmental ratio the moron achieves about two-thirds of his expected mental growth, the imbecile not more than one-half, and the idiot one-quarter or less.

§ 1. IDIOT AND IMBECILE GROWTH CAREERS

These ultimate limits of development are reflected in the progress which is made in the early years of life. It must be recognized that idiocy and imbecility assume extremely varied forms, owing to the diversity of etiological factors. Symmetrical uniform rates of retardation throughout infancy and childhood, such as frequently occur in the primary moron, are less common in the lower grades of deficiency. In many instances of idiocy it is unsafe to base a precise prognosis on the developmental quotients derived in the first few months after birth.

This is due to several reasons: (a) In the early months subcortical mechanisms produce oculomotor and other postural patterns of behavior which may simulate higher patterns; (b) the

maturational determiners of the most primitive behavior patterns, being more deeply intrenched, are less affected than the determiners of more advanced patterns; (c) degenerative processes are cumulative and exceed the rate of aging.

In the lowest grade of idiocy mental development is almost completely wanting. The autonomic system is relatively least disturbed. The vegetative functions of respiration, digestion and excretion are preserved, but the capacity to eat solid foods and even the instinct of sucking may be deficient. In sensori-motor patterns of behavior the profound idiot scarcely rises above a fetal level, and may indeed maintain a huddled antenatal posture. He is capable of stereotyped movements but does not acquire powers of prehension or locomotion. His needs and wants are extremely limited and are readily satisfied by food and warmth. His growth potential is zero.

The highest grades of idiocy approach imbecility and need no separate description. When the idiocy is of a simple primary type, the infant may undergo an extremely slow yet progressive course of development in the motor sphere. He is not likely, however, to rise to a one-year level of maturity even in three or four years. He may, for example, learn to stand with support by the end of three years, but it may take him another three years before he walks independently. This is due to the reduced rate of maturation and to a lack of drive or motivation. His postural stances, his prehensory attitudes, and his locomotor gait show crudities or even discoordination. His vocalizations are sparse, exaggerated, and inarticulate. His emotional life is shallow and unmodulated. His neuromotor equipment is so faulty that he eats solids with difficulty, and usually does not learn to manage a spoon by the age of three. Lacking the requisite cortical growth, he does not acquire sphincter control. Within narrow limits, however, he is conditionable. He may learn a few tricks; he establishes associations between bib and bottle; he enjoys simple infantile pleasures like bouncing and cuddling.

Idiot infants, like normal infants, show differences in temperament. Some may be quite mild and inoffensive. In the early months they may be regarded as "very good babies." They eat and sleep with docile regularity; they gain weight so steadily that parents are satisfied with the progress made. The eyes are wide open and give a false impression of attention. The co-ordinate eye movements

impart a suggestion of normality. The mother may not worry about her child until he fails to sit up when he is 9 to 10 months old. Then she seeks medical advice.

If the infant is of the excitable rather than the apathetic type, he is likely to be troublesome and, on account of his irritability, given to excessive crying. In later years such an infant may be destructive and impulsively violent. In the first three years he acquires pronounced stereotyped movements,—body swaying, head rolling, tongue chewing, scratching, brushing, head banging, grunting, snorting, bizarre variations of breathing, fetichistic attachments, and other idiosyncrasies.

These stereotyped movements are not in the nature of perversions. They are fixations of pattern. A normal infant does not ordinarily establish permanent fixations because he is constantly changing and expanding the frontiers of a growing reaction system. He progresses from scratching to grasping. But the low grade ament has such low grade growth potentials and such restricted equipment that his reaction system is relatively static; it does not yield to the ferment of development; instead it settles here and there into rigid patterns of response which are so unvarying that they seem to possess the child.

So extremely slow is the pace of development in the idiot that even in adult years he continues to function at an infantile level, always lacking, however, the dynamic vividness and vitality of a normally growing infant. Only in a limited descriptive sense is he comparable to the normal infant. He is likely to be most comparable when the amentia is due to a generalized germinal defect which impoverishes the whole complex of development in a symmetrical manner. Such classical reductions are extremely rare. More commonly the total physiology of development is so disturbed that the resultant structures of behavior are not only weak and unformed, but malformed.

When idiocy is due to intrinsic pathological changes within the central nervous system, as in progressive deteriorative disease, the organization of behavior is not only retarded, it undergoes disintegration. A series of behavior examinations in the course of the first three years shows actual decline and diminution. Such infants are at their best in the very first months of life.

Another important and relatively numerous group come by their defect through trauma, asphyxia, cerebral hemorrhage, and meningitis. This group naturally presents a vast array of clinical features because the cerebral damages have a selective and unevenly destructive effect. Some of the specific growth capacities may remain more or less intact. Accordingly even a profound idiot may walk at a relatively early age. Children suffering from such secondary amentia often display an impressive perfection of physique and countenance. Curious residuals of normality crop out incongruously in their behavior traits. These children are entitled to discriminative interpretation. If they are idiots their idiocy is of a different caste from that of the primary ament.

Physical appearance, however, is an untrustworthy criterion of idiocy. Some children look normal but are profoundly idiotic. Other children because of their motor disabilities give the impression of idiocy, but are not idiots at all. Nowhere is careful differential diagnosis more important than in this latter group of cases.

§ 2. Mongolism

Mongolism is one of the most distinctive forms of amentia. This very distinctiveness has led to a certain over-emphasis of the subject in medical writings. Tredgold states that of all children diagnosed as mentally defective during the first year of life, between 40 and 50 per cent are mongols. Yet only 5 per cent of the total population of defectives are mongols. This can only mean that other forms of infant amentia should have more attention, because practically all forms can be recognized in the first year. Mongolism nevertheless presents problems of medical and social importance which justify special consideration.

One fanciful and now discredited theory advanced the suggestion that the mongol in our Caucasian midst represents the persistence of an ancient racial stock. There is no reason to think that clinical mongolism has any specific anthropological significance. Clinical mongolism appears among many peoples, more frequently in some countries than others, and perhaps more frequently in the favored social classes. It also seems to be somewhat on the increase. But it has been found in a wide array of racial stocks including Hindus, Jews, Chinese, Japanese, and Negroes.

Irrespective of race, there is a strong family resemblance among all of the cases of clinical mongolism which suggests a deep-seated developmental anomaly rather than a specific hereditary entity. In many instances the family history is notably free of mental defect. The primary nature of mongolism, moreover, probably accounts for the fact that mongolism is invariably confined to one of a pair of fraternal twins. The possibility of an endocrine factor is suggested by certain features of resemblance between mongolism and cretinism. As a matter of fact the resemblances are rather superficial; the differences are fundamental and significant. The mongol lacks the physical signs of metabolic disturbance, and he lacks the myxedematous infiltrations which impose their hallmark on the cretin.

About two-thirds of all cases of mongolism are born to mothers past the age of 35 years. This fact points to reproductive exhaustion as a causative factor. Notwithstanding, many mongols are first-born, and subsequent children are almost always normal. Only in the rarest exceptions do two mongols appear in the same family, barring identical twins. The relatively high incidence of prematurity among mongols should be mentioned in this connection. Rosanoff suggests that mongolism is due to climacteric or premature ovarian atrophy, and to local or diffuse sclerotic changes. In any event, mongolism classifies best as a primary form of amentia.

The course both of physical growth and of mental growth in mongolism suggests that the impetus of development is stronger in the infant years than in later years. In terms of weight, the physical development of the mongol clings fairly closely to the average trend. The curve for height falls within the lower normal limits during the first two or three years, but thereafter mongols as a group are subnormal in stature. Physiological reductions are shown in poor circulation, shallow respiration and susceptibility to infection The genital organs are small; the secondary sex characteristics are retarded and poorly developed. Life expectation also is subnormal; few mongols survive the third decade.

The physical characteristics of mongolism similarly reflect faulty growth. But the infant mongol is under no necessity of fulfilling the specifications of the full-blown textbook model. Some of the classic stigmata will therefore prove to be lacking. His skin is smooth

and delicate, his hair soft and quite abundant. The skull is small, round, and short in the anteroposterior diameter. Sphenoid and maxilla being underdeveloped, the face is somewhat flattened, the nose squat and the chin prognathous. These malformations tilt the eyeslits upward and outward. Ears are frequently misshapen; mouth is open but lips and tongue are smooth and in the early months not exceptional. Hands are fat, fingers short, thumb very short. The feet show a large cleft between the first and second toes. Potbelly and umbilical hernia are common. After the first few years the mongol approximates more closely the standard clinical picture: hair and skin coarsen; lips and tongue thicken, roughen and fissure; fingers taper; movements become more clumsy and awkward; the voice sinks to a guttural. The mongol may remain unidentified if the physician expects to find all these grosser features in the period of infancy.

A diagnosis of mongolism on the basis of physical characteristics can be made at birth even in an infant prematurely born. None of the characteristics is peculiar to mongolism; some may be absent in any given case, and all of them may be found in other types of amentia. But in the mongol they present a distinctive composite. The composite is so striking that the experienced eye may make a diagnosis by a mere glance at the profile or posture of the infant. The initial impression of the total constellation is diagnostically most trustworthy if it is supported by physiological and behavioral signs. There are occasions when a differential diagnosis on the basis of physical characteristics has its difficulties. The premature infant sometimes bears a mild though wholly fictitious resemblance to the mongol, and errors of diagnosis are made if too much weight is placed on the obliquity of the eyeslits.

The behavior characteristics in the infant mongol also present a distinctive composite. In addition to a basic developmental retardation, clinical features include the following: placidity and inertness in the apathetic type; restlessness, grimacing, snorting and pseudo-alertness in the more excitable type; and a general dynamic reduction with fragments of plausible behavior. An affectionate disposition, cheerfulness, imitativeness, and fondness for music and rhythm and social attention are characteristic emotional traits.

The typical mongol is developmentally at his best during the first

year of life. In the first weeks some of his behavior may be at a relatively normal level. But he soon displays a retardation which increases in severity as he grows older. We have found that the statistically typical mongol sits alone at the age of 1 year; walks alone at the age of 2 years; uses words and possibly phrases at the age of 3 years; feeds himself at the age of 4 years; is toilet trained at about 5 years; speaks in simple short sentences at 6 years.

The vast majority of the quotients for the periods of infancy and childhood range between 30 and 60. Up to 4 years developmental quotients as high as 75 are frequently encountered with a range of variations as low as 20. After the age of 4 years, the zone of variation narrows decidedly and the general trend goes downward. Under 4 years of age, three-fourths of the mongols have D.Q.'s of 50 or more. Above 4 years of age the proportions are reversed: three-fourths have D.Q.'s below 50. Progressive retardation is the rule, and as time goes on the rate of mental growth becomes extremely slow.

For example, a mongol boy of three confronted with the problem of seating himself in a small chair, leaned over, peered between his legs, backed up and missed his mark completely. A year later his ineptitude was equally comical. This ament had not mastered in a year's time a feat which the normal child achieves in a matter of days.

The psychological characteristics of the mongol often make him an amenable subject for home care, particularly during childhood. If the parents are young it is nevertheless advisable to encourage prompt institutional care or foster home placement. If the parents are older and the family circle larger, the mongol infant may be more readily assimilated into the household. As he grows older his imitativeness, his love of praise and attention, his amiability, make· him something of a pet. His mimetic capacity enables him to learn tricks which amuse the family. As the backwardness of the mongol becomes more conspicuous with his increasing size and age, the adjustment in the home is not so simple. Under institutional auspices the mongol remains happy and contented even though he can scarcely cope with his mental age equals in routine tasks or in vocational performance.

§ 3. Congenital Abnormalities

Congenital anomalies and malformations are frequently associated with amentia. This is not surprising because, whatever their origin, they represent some failure or disturbance of the normal process of development. Moreover, statistics show that well over half of the gross congenital abnormalities involve the central nervous system, including a large proportion of cases of hydrocephalus, with and without spina bifida.

Gross congenital malformations as recorded on a large series of death certificates afflict approximately one in every 213 infants born alive; and almost 25 per cent of the congenitally malformed are stillborn. In comparison with the general population, a family with one malformed child is twenty-five times more likely to have another malformed child in subsequent offspring. In his extensive study, D. P. Murphy found evidence that the causative factors operate prior to fertilization. Corner, however, on the basis of investigation of laboratory animals, comes to the conclusion that a bad egg in a good environment, or a good egg in a bad environment, produces similar abnormalities. He draws up a whole series of causes classifiable as; (a) defects of fertilization, (b) defects of maternal environment, (c) defects of the egg, the sperm and the embryo. The third category is probably most numerous, including many cases aborted very early. Spontaneous abortion may signalize a fetus so gravely imperfect that it can not survive. Prematurity, likewise, is sometimes suggestive of the presence or threat of a developmental anomaly.

The incidence of prematurity and of abortions in mongolism, for example, is many times greater than that of ordinary hospital newborns. The precise cause of mongolism is unknown; it has been vaguely ascribed to a general maternal disorder and, again, to a constitutional flaw, which is neither inherited nor inflicted by external factors. Benda has found indications of thyroid and pituitary deficiency related in some way to the same conditions which bring about abortion, threatened abortion, prematurity, and hormonal sterility. Since the exact role of secondary factors is not established, mongolism may be classified as a primary form of amentia and is separately discussed in § 2.

Recent discoveries have revealed that toxic, infectious, and immunological complications may operate at various stages of gestation in the production of abnormalities. In *erythroblastosis fetalis*, the affected fetus is originally not defective and is potentially normal. A biochemical incompatibility between mother and child set up by an Rh factor, causes a toxic substance to pass from the maternal bloodstream through the placental barrier, damaging the blood cells and the bloodforming organs of the child. If jaundice develops early the result is stillbirth or the child dies usually within ten days. The developmental outlook of those who survive is relatively good, but in some instances the sequelae include amentia, spasticity, and diplegia.

Equally striking, though much rarer, is the adverse environmental effect of heavy doses of radiation on the growing human embryo. Numerous insurance factors (including the placental barrier) protect the fetus in many instances from harm occasioned by faulty nutrition and by vitamin deficiencies on the part of the mother; but heavy radiation in the early stages of pregnancy can undoubtedly produce amentia and congenital malformation's.

Embryonic undifferentiated, and actively differentiating tissue is peculiarly susceptible to virus damage. This has been dramatically established by the Australian report of congenital anomalies following maternal rubella in the early weeks of pregnancy (Gregg, Swan, *et al.*). A total of 109 cases recorded revealed a variety of severe abnormalities, with congenital cataracts, deaf mutism, cardiac septal defects and microcephaly most frequent, both singly and in association. In the original series of 78 cases, all were found to have cataract at birth (bilateral, 62; unilateral, 16). Available data show that virtually all the mothers who contract rubella in the first two months, and about half of those who contract it during the third month, give birth to infants with congenital anomalies. Nearly all the children apparently are feeding problems, poorly developed physically and also mentally. Many prove to be aments.

The virus of rubella may have increased in toxicity in recent years. The findings of the Australian survey have been confirmed in America and other countries. The timing as well as the severity of the infection appears to be of great importance in determining the nature and severity of the consequent anomalies. It is now clear

that other deleterious agents operating in the prenatal period may produce a wide array of defects and deviations, which manifest themselves in behavior signs. The fact that the nervous system and sensory organs are so frequently involved in congenital pathology, lends added significance to the early developmental diagnosis of infant behavior. Although the same causes which produce physical abnormalities may also produce amentia, it must be recognized that a congenital defect sometimes is precisely delimited and does not contraindicate an otherwise normal course of development. The chapter on sensory handicaps will show that blindness and deafness, whether congenital or acquired in early infancy, may be so restricted as not to impair the basic growth potentialities in other fields of behavior. (Chapter XIII.)

It is not always possible to draw a sharp distinction between a developmental anomaly and a disease process. For example, the pathogenesis of *retrolental fibroplasia* has not yet been determined. This lesion can be described as a form of ocular maldevelopment, because it is closely linked with extreme prematurity, and only rarely occurs in full term infants. Over 10 per cent of infants weighing 3 pounds or less at birth are blind from this defect (Terry). The blindness is caused by an opaque sheet of vascularized tissue behind the crystalline lens. What causes the multiplication of embryonic connective tissue in the persisting tunica vasculosa lentis is not known. In any event, this form of ocular maldevelopment results in almost complete blindness, without necessarily directly impairing other functions. But the frequent association of sensory defects with amentia and retardation shows that developmental anomalies are not readily circumscribed. The behavior capacities of the infant most completely sum up the extent of the damage which he has suffered.

§ 4. Illustrative Cases

A. PRIMARY AMENTIA

Simple Deficiency

CASE 1 had a feebleminded mother. He had been placed with a view to ultimate adoption with a young couple who became concerned over his slow progress.

At *45 weeks* his head circumference was 40.9 cm. (9 weeks level); his general maturity level was about 16 weeks (rolls from prone, arms activate and contact toy, laughs, automatic social smile). The behavior patterns were defective in quality. D.Q. about 35.

At *20 months* his head circumference was 42.6 cm. (15 weeks level). Attention was very poor and he crawled about aimlessly. His general maturity level was about 20 weeks (grasps toy on contact, obtrusive hand regard, no regard for pellet). Gross motor behavior was slightly more advanced. D.Q. about 25.

This case illustrates slow, decelerating development and hereditary factors. The small head size is to be considered as associated with the lack of cerebral development but not as causative.

CASE 2 had always been a very "good baby," content to be left alone for hours. Development had always been slow. He was first examined at *3½ years* of age. Left to his own devices he wandered about the room aimlessly, climbing, screaming, whistling, and fingering objects idly. He did respond in some measure to loud, stern, insistent commands and could thus be induced to conform to the requirements of the examination. His general maturity level was approximately 18 to 21 months, D.Q. 45-50. He built a tower of cubes, dumped the pellet from the bottle, turned the pages of a book and placed all the forms in the formboard; he had no words.

At *5½ years*, after two years in a special school, he is controlled, obedient and "trustworthy," having stabilized his activities and advanced in social adaptability. Developmentally, however, he has made essentially no progress. D.Q. 25-30.

The decelerating developmental trend has reduced this boy from a high grade imbecile level to a high grade idiot level. In a suitable environment and with skillful training much of his disturbing erratic behavior has disappeared. He is another example of simple primary deficiency.

Aplasias and Malformations

CASE 3 was born 4 weeks prematurely; he required resuscitation at birth and respiratory stimulants for three days. The head was peculiarly shaped (oxycephaly), the eyes very prominent and vision was doubtful; the infant was very irritable.

At *15 weeks* the anterior fontanelle was closed; the infant was con-

sidered probably blind. Irritability was extreme. His general maturity level was approximately 4 to 6 weeks. D.Q. about 25.

At *28 weeks* there was no evidence of progress. He was more quiet but still irritable though receiving luminal. General level 4 to 6 weeks (lifts head 1 inch in prone, vocalizes "ah," responds to bib under chin). D.Q. about 15.

Death overtook this child at 11 months of age, the cause of death being given as catarrhal laryngitis. The outstanding features of his brief career were the congenital abnormalities, the irritability, and the almost complete lack of developmental progress. It may be remarked that many defective infants react very poorly to the birth process.

CASE 4 has an older defective sister of similar appearance; there are five normal siblings. At birth the facies was large and flat, the cranium excessively small and flat, giving him a frog-like appearance. At 19 weeks the anterior fontanelle was closed. The head circumference 36.5 cm. (2 weeks level).

At *24 weeks* he showed a very defective picture of 12 weeks' development (t-n-r and symmetry, coos, laughs softly, regards a cube, hand regard). D.Q. about 50.

At *25 months* his behavior was disorganized and deteriorated, though fragments of his earlier behavior patterns were still evident. Head circumference 40.8 cm. (8 weeks level). D.Q. about 15.

Congenital anomalies are common among this group of aments; in this case the malformation and maldevelopment of the cranium and the malformation and maldevelopment of the brain were closely related. The presence of the same condition in a sibling points to a specific inheritance factor.

Degenerative Processes

CASE 5 did well for the first three months; he held up his head, followed a moving person, cooed, smiled, chuckled, and played with his father's necktie. At the age of 4 months he had a convulsion, followed by frequent minor attacks (8-10 daily). His development regressed; he stopped noticing, became restless and irritable, no longer held up his head, ceased to make social responses.

At *29 weeks* the face was expressionless, the occiput flat, the head circumference 41.5 cm. (12 weeks level). His maturity level was near 6 weeks (no head control, faint facial brightening, follows moving person). D.Q. about 20.

CASE 6 also had an early normal development. She laughed at 2 months and followed objects with her eyes. At 3 months she began to have attacks of twitching and fretfulness, followed by convulsions. By the end of the month she had lost many abilities and was less alert.

At 28 *weeks* she showed occasional spasmodic jerking movements. The reflexes were hyperactive and there was ankle clonus and a positive Hoffman sign. She was practically immobile and unresponsive. Her general level was below 4 weeks (complete head lag, drops rattle immediately, only momentary ring following, fixes examiner's face). D.Q. about 15.

These stories are typical; the infants nearly always appear quite normal at birth, thrive and do well for 3 to 4 months. Then convulsions begin, behavior regresses, neurological signs may or may not appear, but development ceases and profound idiocy supervenes—cerebral degenerative disease.

CASE 7, a large, well formed Jewish infant presented no unusual symptoms during the neonatal period. First developmental examination at the age of 56 weeks revealed an atypical behavior picture, with neurological symptoms, perhaps more suggestive of cerebral maldevelopment than of injury. Neck, back, shoulders, and arms were hypotonic; legs were variably hypotonic and rigid; reflexes hyperactive; feet were everted. Unable to sit alone, she was supported in her mother's lap; her head sagged forward; her back was markedly rounded. She grasped a cube with a weak radial palmar grasp; regarded a third cube and also a pellet. Eyes were half closed and showed alternating strabismus. Motor symptoms were much more prominent than the visual. Exploitive drive was very low. The behavior patterns were meager, and did not rise above the 24 weeks level, but they were not in themselves distorted.

On re-examination at the age of 18 months, a full blown picture of *amaurotic family idiocy* unfolded: progressive retardation; heightened reactiveness to sound; increased rigidity; blindness; a conspicuous alternating tonic-neck-reflex, easily induced by passive head rotation. All social responses had vanished; she no longer recognized her mother; she was unable to grasp a cube. Ophthalmoscopic examination revealed a white patch with a central cherry-red spot in the macular region of each eye.

B. SECONDARY AMENTIA

Hemorrhage

CASE 8 was resuscitated with difficulty after birth. A diagnosis of cerebral hemorrhage was made and he remained in the hospital for fifteen weeks with symptoms of twitching and vomiting.

At *35 weeks* he was a large irritable baby with a small head and closed fontanelles. He had a left unilateral strabismus, hyperactive reflexes, and hypertonic extensor muscles. His general level was not above 4 weeks (lifts head 1 inch in prone, attends bell, follows ring briefly, no social responses). D. Q. about 10.

At *52 weeks* his level was in the 8 to 12 weeks zone (regards cube, coos responsively and smiles, engages in hand play). Neurological signs persisted. D.Q. 15-20.

This boy is making slow but consistent progress at the idiot level. His amentia is secondary to the damage suffered at birth.

CASE 9 was born at home and developed hemorrhagic disease of the newborn. He was hospitalized on the sixth day but by that time he was very ill, had numerous ecchymoses, the fontanelle was tense and he had a hemorrhage of the optic disk. With heroic treatment he survived.

At *29 weeks* he was totally blind and his behavior responses were very meager. With respect to sleep and activity rhythms he was near the 4 weeks level. D.Q. about 15.

At 18 months he was limp and hypotonic and subject to minor convulsive seizures. His general level was below 4 weeks (quiets to sound, pursues bottle with mouth, quiets in bath). D.Q. 0-5.

This amentia is manifestly due to devastating destruction from hemorrhage in the neonatal period.

Infection

CASE 10 was born with some difficulty; the left femur was fractured. He had congenital syphilis with osteitis, periostitis, ephiphysitis, white patches on the tongue, rhagades about the mouth, snuffles and general lymphadenopathy. Antiluetic treatment was instituted. At 4 months he had pneumonia; at 6 months pneumonia again.

At *30 weeks* vision was obviously defective and his behavior was retarded to the 12-16 weeks level (lifts head to Zone III in prone, coos and smiles as regards his hand; he follows the ring 135° and regards it briefly in hand). D.Q. about 45.

At *48 weeks* vision seemed slightly improved, but his responses showed very little alteration. General level 12 to 16 weeks. D.Q. about 25-30.

This is secondary amentia of severe grade due to congenital syphilis.

CASE 11 was circumcized on the ninth day after birth. He promptly developed a fever and by the fourteenth day had convulsions, signs of meningitis, and frank pus in the spinal fluid (B. coli). After strenuous

treatment he recovered from the meningitis but slowly developed a hydrocephalus.

At *28 weeks* the head circumference was 47.3 cm. (52 weeks level) and he had a hydrocephalic squint; he could not support his head. The arms were somewhat rigidly semi-extended; prehensory approach was incomplete, grasp was defective. No response to sound was elicited; there was no real evidence of social interest. His general maturity level was approximately 14 weeks (regards rattle in hand, hand regard, regards cube). D.Q. about 50.

At *56 weeks* the head is still slowly increasing. He is a happy playful infant, oblivious to sounds and to social approaches. He plays with a rattle, regarding it in hand, and he plays with his fingers. His general maturity level is approximately 16 weeks. D.Q. about 30.

This is another example of secondary amentia of infectious origin: B. coli meningitis followed by amentia, hydrocephalus and deafness.

CASE 12 developed normally to the age of *25 months* when· she had measles with severe convulsions; a diagnosis of measles encephalitis was made. Since that time definite character and personality changes have taken place. The child became over-active, violent, destructive, stubborn, and generally incorrigible.

At *33 months* she was a disorganized deteriorated child, controllable only for brief intervals. Her general maturity level was approximately 15 months (fills cup with cubes, imitates scribble, throws ball, 2-3 words). D.Q. about 45.

At *44 months*, after ten months of institution life, she is more quiet and manageable though she has frequent attacks of excitement. Although her behavior is socially more acceptable she has made essentially no developmental progress. D.Q. about 35.

In this instance measles encephalitis resulted in amentia.

Anoxemia

CASE 13 was born prematurely weighing 3 lbs. 2 oz. (fetal age 29 weeks). He gained well and was considered a normal infant. At 6 months of age he smothered in his blankets in bed. He was lifeless and black when found; on resuscitation he was pallid, had a fixed expression and increased respirations. The parents date his retardation from this episode.

At *55 weeks* (corrected age, about 44 weeks) his behavior was retarded and deformed. His movements were distinctly athetotic. His general maturity level was approximately 20 to 24 weeks (approaches objects, grasps on contact, no regard· for pellet, coos and laughs). D.Q. about 45.

At *18 months* (corrected age, about 15 months) his greatest gains interestingly enough were in the motor field in spite of the motor handicaps. He could sit alone, creep and cruise, but in all other fields of behavior his general level was not above 28 weeks (transfers toy, holds 2 cubes, stereotyped hand regard, no "dada"). D.Q. about 45.

Secondary amentia is in this case the sequel to a serious asphyxial episode in a premature infant.

Prenatal Rubella Virus

CASE 14 was born with a birth weight of 2 lbs. 12 oz. but on the basis of menstrual history was adjudged to be at full term. Mother contracted rubella 65 days after the last menstruation. Labor normal except for placenta previa and excessive bleeding. Infant gained to a weight of 5 lbs. after 7 weeks. Was active and of normal facies. An over-optimistic estimate by one physician at the age of 10 months attributed the retardation to a dense cataract of the right eye which was also microphthalmic and had been needled at the age of 12 weeks. An electroencephalogram at the age of 9 months, however, showed an atypical frequency difference between the occipital region and the central and frontal region suggesting localized damage or some cerebral agenesis. The general pattern of the record was considered to be closer to the age of 3 months than to the age of 9 months. Other physical anomalies included marked asymmetric cranium, overlapping of middle toes, undescended testicles, poorly defined junction of upper lip and nasal septum, and a cardiac lesion.

Developmental examination of behavior revealed·extreme and irregular retardation. The infant stared vaguely at overhead lights. He gave no social regard to persons. His preferred activity was mouthing of one or both hands. From time to time he removed hands from the mouth and extended one arm in a salute-like pose and fixated on it in a manner suggesting hand inspection. He needed support in sitting. Head station was unsteady. Recurrently he looked down at the table top and vaguely regarded his hand. No voluntary grasp or reaching. No reaction to sounds. Behavior picture too irregular to assign a single maturity level. Diagnosis: amentia of severe grade following maternal rubella.

These case reports could be multiplied almost endlessly. Each story differs in detail, each child presents a unique behavior picture, and has his own individual growth career. Some are quiet and inert, others plod laboriously and slowly through the early phases of development, others are bizarre and disorganized in behavior, still

others excitable and violent; there is a wide variety of neurological signs and patterns. The common feature is an extreme failure of normal development.

Development is the business of the infant and child; it is his task. And if he fails at this task it is a very serious matter. There is no second chance, he cannot do it later and make up for lost time. There can be no light-hearted, off-hand extenuation; failure of normal development in infancy is insuperable because of the indivisible unity of life, growth, and age.

CHAPTER IX

ENDOCRINE DISORDERS

Statistics show that the incidence of cretinism and goiter has steadily increased in the United States since 1900. Indeed, goiter is sufficiently prevalent in some regions to suggest that with neglect and inbreeding, local areas of endemic cretinism may develop. Although clinical cretinism is at present relatively infrequent in this country, it is believed by some that mild hypothyroidism is already a social and educational problem.

Jackson subscribes to the view that goiter is the first degree of a degenerative process that may culminate in cretinism. Other investigators make a distinction between goiter, cretinism, congenital and acquired hypothyroidism on the basis of etiological factors and time of onset in the life cycle. Certain it is that there are different degrees of thyroid deficiency and that onset very early in life is associated with serious retardation in behavior development and marked imperfections of physical development.

§ 1. CRETINISM

The thyroid gland, like any other gland, is subject to defects which impair its development, reduce its secretion, and disturb its normal interaction with associated glands. Cretinism is usually regarded as a secondary type of amentia attributable to a congenital but not hereditary absence or deficiency of the thyroid gland. The thyroid secretions of the mother and the presence of thyroxin in the mother's milk protects the growth of the organism throughout gestation and in the early postnatal period. If, however, the defect in the thyroid gland is but one aspect of a primary germinal defect, the cretinism must be regarded as a complication of primary amentia.

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Deficiency of thyroxin lowers the basal metabolic rate and depresses physiological functions; it slows down the growth of the skeleton and brain. The mental deficiency is ascribed to a malformation of the capillaries of the cortex similar to that seen in the nail beds. Temporary thyroxin deficiency, however, does not directly destroy the inborn potentialities of growth. When these are normal the most striking miracles occur with thyroid therapy.

We have divided the signs and symptoms of cretinism into four categories: (a) *metabolic,* including low temperature, slow heart rate, absent perspiration, poor appetite, constipation; (b) *infiltrative,* including thick tongue, myxedematous infiltrations, thick skin, fatty pads; (c) *skeletal,* including short stature and excessively short legs, slow dentition, delayed fontanelle closure and delayed development of epiphyses; (d) *developmental,* including amentia, slowed reaction time, sluggish emotional responses, etc.

Clinical experience shows a wide range of response to treatment though all cases show improvement in the metabolic and infiltrative signs. A poor response leaves the child seriously amented and usually also dwarfed; an intermediate response leaves the child physically normal or only slightly dwarfed but with only a very modest and incomplete improvement in intellectual capacities; a good response produces a child who is physically and mentally normal. The intermediate response is the most common; the satisfactory response, the least common.

The type of response is related in all probability to the degree and time of developmental injury rather than to the time at which treatment is begun. This is not an argument against early treatment, but an argument against unwarranted optimism over the results of early treatment.

Punctual diagnosis does increase the chances of satisfactory treatment results, and if due attention is given to all the symptoms, including behavior, cretinism can be recognized very early indeed. It is to be remembered that the thyroid of the mother ordinarily affords the cretinous infant some protection in the early months of life, and only as this protection fails do the signs of cretinism begin to appear, one by one, until finally the full symptom complex is evident.

Most important for the early recognition of hypothyroidism is the

following syndrome: subnormal temperature, slow heart rate, persistent wide fontanelles, dwarfing with disproportionately short legs, submature and sluggish behavior patterns. When these early signs develop cumulatively they justify a suspicion of hypothyroidism. They also justify the administration of thyroid *as a diagnostic test*. Diagnosis should be made before the development of full-blown cretinism which is the terminal expression of an infiltrative process of long standing.

When thyroid is administered the response to treatment becomes part of the total symptomatology. The therapeutic response is an index of the reserve capacity of the neuro-endocrine system and helps to define prognosis as well. This can be demonstrated by summarizing the developmental careers of three infant cretins.*

Poor Response to Thyroid Therapy

In CASE 1 the diagnosis of cretinism was made at 32 *weeks* of age. She was an undersized baby with the absurdly short legs, potbelly, umbilical hernia, enormous fat pads about the neck and shoulders, thick protruding tongue and widely open fontanelles characteristic of cretinism. The skin was cold and dry, the heart rate 108. She was placid and almost completely inactive; her voice was hoarse and croaking. She responded slowly and sluggishly at a general maturity level of about 12 weeks. (D.Q. about 40.)

Thyroid therapy was instituted at 36 weeks. After 8 weeks of treatment the metabolic and infiltrative signs had disappeared completely; she remained a dwarfed and retarded baby. She seemed more active and playful but showed no acceleration in developmental rate.

After 18 months of treatment she had made the fullest therapeutic response of which she was capable. Her D.Q. rose from about 40 to about 50; dentition and epiphyseal development were normal; stature was still dwarfed although her legs were no longer disproportionately short; she had changed from an almost somnolent ament to an active merry ament. But she was still an ament. And at the age of 7 *years* she still remains an ament. She has continued her defective and slow development but there is no real improvment, and the effects of treatment are far from brilliant. Case 1 represents most probably an instance of cretinism superimposed upon a primary amentia. (See adjoining chart.)

* Gesell, A., Amatruda, C. S. and Culotta, C. S.: Effect of thyroid therapy on the mental and physical growth of cretinous infants. American Journal Diseases Children, 1936, November, 52, 1117-1138.

MEAGER RESPONSE TO THYROID THERAPY

Case 1 (Girl 36 A) was the eighth child in a large Italian family; 7 older and 2 younger siblings are living and well. Labor was induced because of signs of toxemia. Birth weight, 6¼ lbs. (2835 G.)

Age 10 days. Abdomen tense and prominent.

3 weeks. Temperature subnormal (96.6°).

7 weeks. Color sallow. Umbilical hernia. Sluggish reactions, mentality questioned.

13 weeks. Alternating strabismus, continuous lateral oscillation of eyes Abdomen distended and tense.

15 weeks. T-n-r prominent. No spontaneous head turning; no ocular fixation; no listening; grasp brief and reflexive; no social smile. X-ray shows delayed ossification. Impression: "Facies cretinoid. Probably blind, possibly deaf. Undoubtedly defective."

20 weeks. Mouth slightly open, tongue tip protrudes but tongue itself is not large; posterior fontanelle open. Dusky, mottled skin. Eyes now fixate, follow moving light. Prehension defective. No exploitive finger play. Feeble social response. T-n-r still prominent. Postural reactions at 8 to 12 weeks level. Adaptive behavior near 8 weeks level. Impression: "Still looks cretinoid, but believe the defect is primary."

Thyroid treatment suggested, but is not actually begun till age 36 weeks.

32 weeks. Full blown physical signs of cretinism Behavior symptoms: Unduly placid, inactive; voice hoarse; social responses meager. Regards hands, regards cube; follows dangling ring; hands engage for mutual fingering; head control more steady. Behavior level near 12 weeks.

36 weeks. Thyroid therapy begun (desiccated gland: dose of 1 grain daily, increased to 2½ grains by age of 2 years).

40 weeks. (After 4 weeks of treatment.) Heart rate and temperature normal. Tongue slightly smaller. Abdomen less protuberant. Skin warmer. Perspiration has appeared. Appetite improved. More active and alert. Rolls to side. Beginning to play with rattle. Behavior level about 14 weeks.

44 weeks. (After 8 weeks of treatment.) Cretin appearance entirely lost, though facial expression remains stupid. Posterior fontanelle closed, lids and lips normal; fat pads gone; neck has emerged; umbilical hernia disappeared. Scratches table top. Plays actively with rattle. Behavior level: 16 weeks.

12 months. (After 16 weeks of treatment.) Physical improvement continues; but has no teeth. Tongue smaller; mouth closed. Abdomen flat. Promptly closes in on dangling ring; but does not grasp cup. Attention very faulty. Behavior at a defective 20 weeks level.

15 months. (After 29 weeks of treatment.) Has 4 teeth. Expression more animated. Reaches promptly for objects, seizes a pellet with crude pincer grasp. Uses handle of cup selectively. Modes of attention now remarkably more normal but developmental ratio not much altered. Behavior level near 30 weeks.

18 months. (After 42 weeks of treatment.) Has 8 teeth; anterior fontanelle is closed. Only remaining signs of cretinism are delayed dentition, dwarfing and mental retardation. Sits alone, but does not creep. Exploits toys by mouthing, combining, and transfer. Plays patacake; says dada; imitates sounds. Behavior level 40 weeks. D.Q. 50.

2, 3, 4, 5, 6, 7 years. Six annual developmental examinations show a relatively constant retardation with D.Q.'s ranging from 50 to 60. Speech at age 7 years rather faulty, but she states actions and names pictures. Builds a tower of 10 cubes. Draws a cross imitatively. Demeanor retains no cretinous features: she is restless, vivacious, demanding, and flighty.

Good Response to Thyroid Therapy

CASE 2 began treatment at the relatively advanced age of *46 weeks*. She had all the physical signs of well established cretinism. Her behavior output was extremely meager, retardation was gross and obvious; her general maturity level was approximately 24 weeks. D.Q. about 50.

After 6 weeks of treatment the metabolic and infiltrative signs of cretinism had disappeared. After only 14 weeks of treatment she began to show an acceleration in developmental rate (D. Q. about 65). After 10 months of treatment her stature and dentition were normal and her D.Q. had risen to 90. At the age of *7 years* she is in the first grade in school, holding her own in competition with normal children of her age. Her I.Q. is 100. She is co-operative, genial, outgoing, and is a distinctly normal, amiable child. (See adjoining chart.)

A comparison of the two cases points to important prognostic facts. The effects of thyroid substance on the cretinous infant are of three kinds: metabolic, somatic, and neuro-developmental. The metabolic response to treatment is the most immediate and the most frequent. These effects involve the vegetative system and the energetics of both physiological and behavioral reactions. Marked physical improvement occurs in most cases, expressed chiefly in more normal appearance, in the loss of myxedematous infiltrations and in accelerated growth of the legs. Normal stature, however, is achieved only very slowly or not at all in the less promising cases. Finally, the neuro-developmental response to treatment is most variable and yet most significant. Here again the most favorable cases show the most immediate effects. A prompt acceleration in both physical and mental growth is detectable if care is taken to measure height, leg length, and behavior development. The take-up or immediacy of the therapeutic response is the most important prognostic indicator.

The time required for the first real absolute gain (an increase of more than 10 points in D.Q. in developmental rate) bears an inverse relation to the total gain. The more delayed the initial gain, the smaller the total increment. The first two years of treatment are of critical importance; therapy then has its greatest effect. After that the effect is merely maintained as long as treatment is continued. Myxedema promptly reappears if thyroid is discontinued.

FAVORABLE RESPONSE TO THYROID THERAPY

Case 2 (Girl 46 S), the fourth child of five pregnancies, the first pregnancy terminating in premature separation of the placenta. Siblings alive and well. Birth and neonatal history were normal. Birth weight. 10 lbs. 11 oz. (4848 G).

Age, 7 weeks. Umbilical hernia noted. Infant severely constipated.

14 weeks. Height measurements show dwarfing.

24–28 weeks. Head control poor. Abdomen prominent; tongue protrudes; posterior fontanelle widely open. A photographic portrait at the age of 26 weeks shows well defined cretin facies.

38 weeks. Beginning to sit up with support and to reach for toys.

46 weeks. Thyroid therapy initiated. Referred for developmental examination. Presents all typical physical signs of cretinism, including slow heart rate (84), subnormal temperature, disproportionately short legs; no teeth; no perspiration. Sits momentarily with passive balance: smiles responsively but not vividly; emotional tone reduced; reactions slow and labored; maximum performance: transfers bell from hand to hand. Behavior level: 24 weeks.

49 weeks (After 3 weeks of treatment.) Facial expression animated. Eyes brighter. Temperature and heart rate normal. Tongue thick but no longer protrudes. Constipation and fat pads have disappeared. More alert. Now takes bottle eagerly and effectively. Showed more activity in developmental examination, but manipulation still awkward and behavior level not markedly raised. Improvement chiefly dynamic.

52 weeks. Posterior fontanelle closed. Perspiration normal. Has 2 teeth. Beginning to combine two objects in exploitation. Sleeps less; talks more; physically more active; less fatigable. Performance slightly improved. Behavior level near 28 weeks.

14 months. (After 14 weeks of treatment.) Facies entirely normal; tongue small; hair and skin of fine texture; voice normal and more modulated; umbilical hernia disappeared. Residual signs: open anterior fontanelle, dwarfing, mental retardation. Sits alone though unsteady; pivots and regresses when prone; rudimentary thumb opposition in prehension. Says "hello," imitates sounds; extends scope of exploitation to side rails. Still shows some blandness and docility. Behavior level near 40 weeks, which signifies a spurt in rate of mental development.

16 months. (After 22 weeks of treatment) Now has 8 teeth. Still docile and placid, but more perceptive of details and surroundings. Accelerated statural growth. Fontanelle closed by cartilage. Behavior level somewhat over 44 weeks.

20 months. (After 39 weeks of treatment.) All measurements except large head circumference now within normal range. Anterior fontanelle closed. Has 16 teeth. Behavior development shows acceleration. Walks alone; climbs up stairs; seats self in small chair. Vocabulary of 25 words. Turns pages; fills bottle with pellets. Behavior level slightly below 18 months.

2, 3, 4, 5, 6, 7 years. Six annual developmental examinations show a well sustained average rate of mental development with D.Q.'s and I.Q.'s ranging from 90 to 100. At the age of 2 years made a significant gain in language, reaching a full average level of performance.

At the age of 7 years she is in the first grade, writes her name, copies a diamond, and converses with ease. She is co-operative, genial, outgoing and gives the impression of being a distinctly normal, amiable child.

Intermediate Response to Thyroid Therapy

Most of the cases of hypothyroidism fall intermediately and unevenly between the two types which have just been illustrated. There is unmistakable physical improvement; the cretin facies for the most part vanishes, some of the apathy disappears, the stature increases, but the developmental effects are not decisive. Without being actually feebleminded, the child is distinctly dull or inferior. Vigorous drive is lacking. The fatigue threshold is low. Even locomotion and manipulation may be somewhat slow and awkward. School progress is retarded; daily performance is variable; the I.Q. fluctuates. Thyroid therapy doubtless saves these children from sinking to a level of imbecility, but it does not restore them to anything like normality or even to substantial adequacy.

The mental growth curves of CASES 1, 2, and 3 (an intermediate case) are shown on the accompanying graph. It will be noted that although thyroid therapy was begun at the early age of *21 weeks* in CASE 3, well in advance of the other two infants, the course of her behavior development falls irregularly between the extremes of defective development and normal development. There was a fairly prompt response in metabolic and somatic improvements; by the age of 18 months her behavior rose to a dull normal level. She was, however, unable to maintain this level and at 5 years must be classified as borderline defective. It is possible that she will show similar fluctuations as she grows older, but the present prognosis is that she will remain in the disappointing intermediate category in which so many cretins fall.

Timely diagnosis is highly desirable, but it takes more than early diagnosis to turn the tide. The final influence of thyroid substance on the cretin is contingent not so much on the age of the child or on his maturity status at the time of diagnosis as on the residual developmental capacity and the latent potency of his neuro-endocrine system. Thyroid therapy cannot bring about normality if the neuro-endocrine system has suffered a significant impairment.

Thyroid Pseudo-Therapy

A word should be added here on the frequent misuses of thyroid treatment. Not infrequently physicians prescribe thyroid as a sort of

placebo. This creates fictitious hopes, and diverts both physician and parent from the real problem, whatever it may be. If uncritically administered the thyroid substance may do actual harm to the
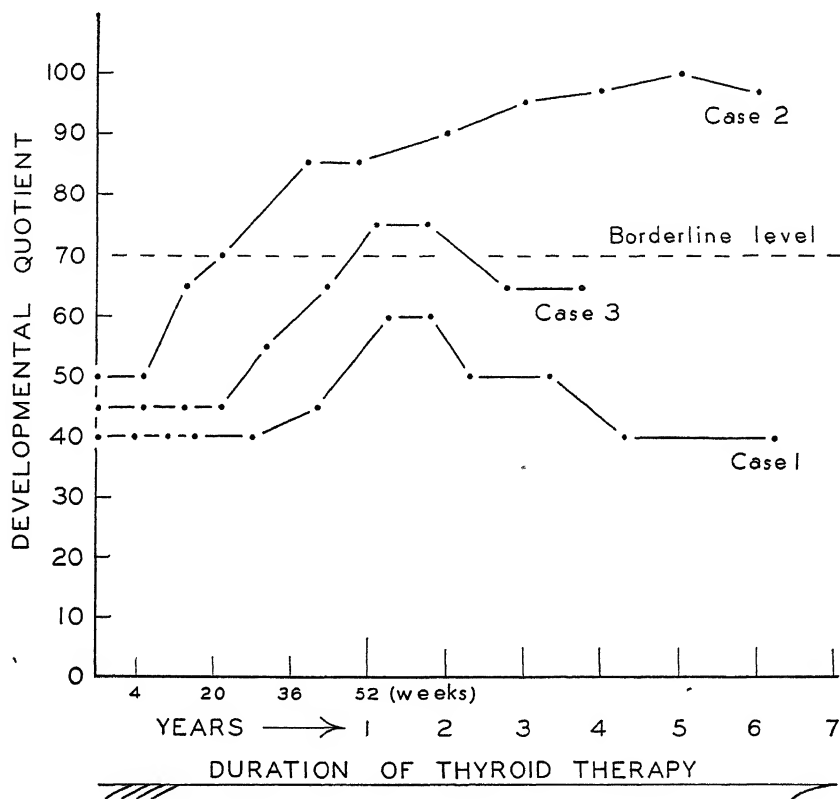

FIG. 8. Mental growth curves showing differential response to thyroid therapy.
Case 1: Treatment began at 36 weeks.
Case 2: Treatment began at 46 weeks.
Case 3: Treatment began at 21 weeks.

patient. It should not be given, for instance, in uncomplicated cases of mongolism. It may be given in doubtfully incipient cases of hypothyroidism if it is critically used as a therapeutic test. The results should then be watched carefully. Infants who react favorably to treatment tend to respond best to comparatively small doses of the dried gland and are intolerant of larger ones. Children who respond unfavorably may not show this intolerance, but they are only slightly

benefited by the larger dose. Uncritical prescription which deludes the parent scarcely deserves the name of therapy, and in the end proves to be a disservice.

§ 2. OTHER ENDOCRINE CONDITIONS

The role of the endocrine system in the production of developmental defects is extraordinarily complicated. Cretinism is one of the best defined of endocrine disorders; but as we have seen, the ratio of interdependence between secondary and primary factors varies with different cases and the priority of one over the other cannot always be certainly affirmed. The relationships and interdependence between the neuro-endocrine system and various disturbances of function are at once so intimate and so diverse that clear cut conclusions as to cause and effect become almost impossible.

Endocrine factors probably figure in the genesis of mongolism but they are so obscure that it is still advisable to classify mongolism as a primary form of amentia. This does not, however, prevent a mongol from developing myxedema. One and the same mother has borne first a mongol and then a cretin. Cretinism like mongolism may be confined to one of a pair of fraternal twins. A mongol may develop Fröhlich's syndrome. The thymus gland is lacking or defectively developed with notable frequency among aments. Epilepsy has been found in association with hypopituitarism. An ament may have hyperpituitarism and may also have an aunt who is a mongolian imbecile! Many endocrinopathies have no marked effect on the course of mental growth.

In cretinism we have found the developmental examination a diagnostic aid and a prognostic guide. Unfortunately it is on the whole much less helpful in other endocrine disorders. Faulty gland structure may simply be one of several developmental anomalies in a primary ament; amentia is then the essential diagnosis and the endocrine disturbance is but a super-added complication. In other cases the endocrine dysfunction is essentially a medical (or surgical) problem without significant developmental complications.

The practical clinician will wish to establish the developmental status and outlook of his patient, but he will not of necessity expect this determination to throw much light on etiological factors. Indeed, the dissociations between endocrine adequacy and developmental

adequacy are as remarkable as the associations. The case reports which follow are cited to illustrate this very point.

CASE 1 is an example of pubertas praecox, a remarkable endocrine disorder manifested in precocious development of sexual maturity. In over three-fourths of the reported cases menstruation began before the age of 5 years, as early as birth in 11 per cent of cases. In this instance, menstruation appeared at 3 years and 7 months. At that age the child's height was only slightly above the average for her age but she had the bodily conformation of an adult woman and all the secondary sex characters were well developed. She died at 18 years following removal of a cerebellar astrocytoma. This tumor probably was the etiological factor at the basis of the endocrine disturbance.

Developmental measurements made at regular intervals between 5 and 18 years showed a striking approximation to an average course of mental growth. The emotional life and personality manifestations were in no way unusual. The stability of mental development in the face of the enormous dislocation in sexual development demonstrates the extraordinary immunity of the central nervous system to certain forms of endocrine imbalance.

CASE 2 is a mentally deficient girl with an I.Q. of 30-35. Menstruation began at 8 years, when her mental age was only 3 years!

CASE 3 is an example of precocious mental development associated with average physical development. At the age of 7 her mental age was 13, her I.Q. 185. Sexual maturation waited its normal time.

These three children at the ages of 3, 8, and 13 years, are brought into close comparison in the accompanying table which suggests that different growth factors which ordinarily are closely interrelated are not necessarily interdependent. Individual growth factors may even have specific determiners.

CASE No.	AGE OF MENARCHE	CHRONOLOGICAL AGE (YEARS)	MENTAL AGE (YEARS)	PHYSIOLOGICAL AGE (YEARS) *
1	3	3	3	13
2	8	8	3	13
3	13	7	13	7

*The average age of menarche in American girls is about 13½ years.

Other endocrine conditions show equally inconsistent develop-

mental pictures. The pituitary gland is an exceedingly important and complex structure and its dysfunctions produce a variety of symptom complexes.

CASE 4 was an obese infant at birth; she weighed 8 lbs. Congenital heart disease (patent interventricular septum) was diagnosed in the neonatal period. Examination at *28 weeks* of age showed her to be a very fat baby, weighing 20 lbs. (1 year level). The thighs, pelvic girdle, and breasts were especially adipose. The facies was peculiar; the cheeks were fat, the expression dour, the eyes very widely spaced. The skin was deeply pigmented although the child was blond; the legs, feet and hands were cyanotic. She was reported to be very resistant to cold and to require little clothing although she was very inactive. At *5 years* she was considerably less obese but maintained the same distribution of fat. The facies had become broad, flat and bland; she had distinct hypertelorism, and widely spaced pegged teeth; lips and nails were cyanotic, fingers and toes clubbed. She was occasionally dyspneic.

The course of her development shows a greatly accelerated weight curve, a normal height curve (the rate of dentition was also normal), and marked progressive retardation in all fields of behavior with an apparent arrest of development at the 15 to 18 months level. (Final D.Q. about 25-30). Motor development has not progressed beyond the 10 months level. Her behavior has been consistently characterized by somewhat bizarre and stereotyped mannerisms.

We consider her an example of multiple congenital anomalies, including congenital heart disease, hypertelorism, dyspituitarism and amentia. This is incidentally a rare and interesting association between hypertelorism, an anomalous development of the sphenoid bone, and a disturbance in development and function of the pituitary gland, housed in a recess of the sphenoid bone.

CASE 5 offers an interesting contrast. This child was seen at the age of *15 months*, when she weighed 38½ lbs. (5 year level). Her height was near the 21 months level. She was enormously fat, and the feminine distribution of the adipose tissue made her resemble an extremely obese woman in grotesque miniature. She showed little drive to gross motor activity and her movements were so slow and deliberate as to seem sluggish. She was such a small eater that her family considered her a feeding problem!

The behavior picture, with the exception of the dynamic reduction, was entirely normal. Even though the endocrine disturbance was more

severe than that of Case 4 (who was a low-grade ament), the behavior development of Case 5 was fully normal.

CASE 6 began to show insidious anorexia and change in facies at about 6 months. He sat alone at 8 months. At 1 year he had an acute febrile illness lasting from two to three weeks, following which the changes became progressively more noticeable. He refused food; vomited frequently; lost weight rapidly. He began to walk alone at 16 months but after a few months stopped walking and refused even to stand. He began to use words at about 2. The head had always seemed large to the parents.

He was first examined at the age of 32 *months*. He was pitifully thin and emaciated. The head circumference was 52 cm. (5 year level), fontanelles closed; weight·16½ lbs. (5½ months level); height normal. The lateral ventricles were symmetrically dilated, the third and fourth ventricles could not be visualized (? obliterated). There was some secondary atrophy of the optic nerve heads; arm and hand movements were slightly ataxic. He was listless, irritable and not very playful but he co-operated in his developmental examination. Developmental status: Borderline.

During the ensuing eleven months he had extensive endocrine and vitamin therapy without any improvement or weight gain. An exploratory tap for a suspected suprasellar cyst failed to encounter any cyst.

On re-examination at 39 *months* he was even more feeble and listless than before and made little effort to comply, giving any casual response that occurred to him. All the pictures, for instance, were "funny things" and no more specific declaration was forthcoming. No performance above the 30 months level was elicited, and the general level seemed nearer 2 years.

The medical considerations are of interest though the diagnosis was never fully established. The etiology of the hydrocephalus and pituitary cachexia were considered possibly due to a residual obstruction from an old meningitis or to an unlocated suprasellar cyst.

Developmental considerations also are of interest. The boy is certainly not an ament; the observable retardation could very conceivably be largely symptomatic of his severe malnutrition and debility, lack of normal experience and prolonged hospitalization. The behavior was greatly enfeebled; but under all the circumstances it is remarkable that developmental retardation and deviation were so slight.

CASE 7 again offers something of a contrast. Her birth weight was 4 lbs. 11 oz. and she has never gained or grown properly from birth. Appetite was always poor; she has had frequently recurring attacks of diarrhea. Because she was allergic to wheat and to cow's milk, various elimination diets were tried without improvement. At 2 years of age she had a course (6 injections) of growth hormone without effect on the dwarfed stature.

Her behavior development has been definitely retarded and there is an· apparent tendency for the retardation to become progressively more marked, although behavior development remains well in advance of statural development.

AGE	APPROXIMATE D.Q.	HEIGHT INDEX*
47 wks.	75–85	40
14 mos.	75–80	30
36 mos.	65–75	50
48 mos.	60–70	50

* The height index is the ratio between actual height age and normal height for age.

She is a very tiny child, very thin, seemingly well proportioned. Actually her head is excessively small, her legs disproportionately long. The face is thin and old; the muscles somewhat atrophic. Bone age is normal, but the skeleton shows some osteoporosis. Endocrine and vitamin therapy have been ineffectual.

This is a very complex picture. Dwarfism is obvious; pituitary infantilism of the Lorain type has been postulated; also a nutritional disorder of the celiac and pancreatic insufficiency type. The associated mental retardation may be coincidental or a part of the clinical picture; the tendency to slow progression is indeed difficult to explain. She is considerably better nourished than Case 6, has much more energy, yet her retardation is much more fundamental.

With the partial exception of hypothyroidism, the relationship between behavior development and endocrine disturbances is at present none too well defined. With the further development of our knowledge of endocrine function it is possible that there will be more control of the processes of early development through chemotherapy. This places a further premium upon the diagnosis of all anomalous types of development.

CHAPTER X

CONVULSIVE DISORDERS

Convulsions figure frequently in the case histories of developmental defect and deviation. A convulsion must be regarded as one of the most important as well as dramatic symptoms in childhood. There is no condition which requires greater scrutiny, for it not only reflects a pathological state but it may, moreover, become a direct causative factor interfering with the normal course of development. Convulsions vary enormously in immediate gravity, from a single benign episode in a fleeting infection to a severe *status epilepticus* which menaces life and may terminate in death, the seizures occurring in such rapid succession that the patient does not regain consciousness. In some instances, however, a convulsion which occurs but once in early childhood may nevertheless have an unfavorable implication and may prove to be a forerunner of serious recurrent convulsions in later years.

There are some sixty possible causes for convulsions and each case needs to be considered in terms of its own history. A distinction should be drawn between recurring and single convulsions; and it should be recognized that in childhood convulsions *per se* do not necessarily produce mental deterioration. The portentous word epilepsy may well be avoided and should not be attached to an acute convulsion which may not prove to be true epilepsy at all.

§ 1. NATURE AND MECHANISMS OF CONVULSIONS

A convulsion is a symptom rather than a disease. The bodily states in which convulsions arise are so numerous that convulsions vary with respect to their mechanisms, as well as their injuriousness. Peterman's injunction, however, is worth repeating: "Every con-

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vulsion produces cerebral injury. Therefore after a convulsion the child must be kept at rest in bed until entirely recovered."

The exact nature of a convulsion or fit remains obscure. It has been variously interpreted as a neural paroxysm in response to noxious stimulation, as a discharge phenomenon associated with defective cortical controls, as a manifestation of nervous disintegration, and as a protective regression resorted to by an over-strained organism. Cobb postulates as many as thirteen physiological mechanisms to explain the occurrence of seizures. Among these *cerebral anoxemia* is the most common; it is brought about by congestion, vasoconstriction, asphyxia and by increased intracranial pressure. The immature nervous system and the inherently unstable nervous system are especially prone to convulsive seizure.

Chemical factors such as toxemias, certain drugs, lead poisoning, and alkalosis may act by direct irritation. Protein shock and anaphylaxis may affect the permeability of the walls of nerve cells and brain, capillaries. Calcium instability, acid-base equilibrium, and water and mineral balance influence the convulsive state.

Impairment of conduction results from embryonic deficiency of brain tissue, from tissue scars and gliosis following encephalitis, and brain trauma. The axis cylinders being extensively destroyed, impulses which normally would flow into the cortex are short-circuited.

Whatever the precise physiological mechanism it is now certain that a convulsion is the outward manifestation of a disturbed rhythm of brain potentials.

In childhood the probability that any given convulsion is epileptic is about one in four. Peterman's 1000 unselected cases showed the following etiological frequencies (in percentages).

```
Acute infection .......................  34.0
Essential epilepsy ....................  23.6
Cerebral injury or residue ............  15.5
Miscellaneous causes ..................  12.7
Spasmophilia or tetany ................   8.9
Cause not established .................   5.3
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The diagnostic probabilities are greatly influenced by the age of the child as shown by the accompanying chart. Of 79 cases of convulsions in the newborn up to 1 month, over two-thirds are at-
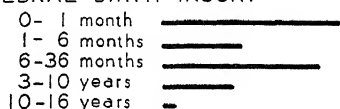
CEREBRAL BIRTH INJURY
    0- 1 month
    1- 6 months
    6-36 months
    3-10 years
    10-16 years

ACUTE INFECTION
    0- 1 month
    1- 6 months
    6-36 months
    3-10 years
    10-16 years

ESSENTIAL EPILEPSY
    0- 1 month
    1- 6 months
    6-36 months
    3-10 years
    10-16 years

TETANY OR SPASMOPHILIA
    0- 1 month
    1- 6 months
    6-36 months
    3-10 years
    10-16 years
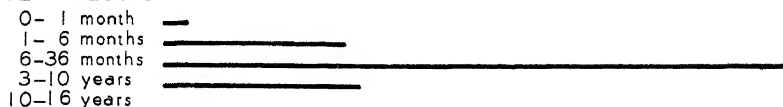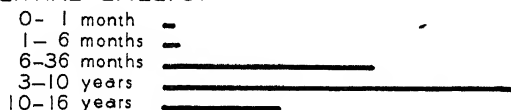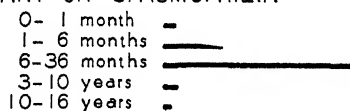
MENINGITIS
    0- 1 month
    1- 6 months
    6-36 months
    3-10 years
    10-16 years
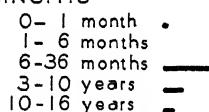
    Distribution of Cases
    0- 1 MONTH,   79 CASES   3-10 YEARS, 251 CASES
    1- 6 MONTHS, 138 CASES   10-16 YEARS, 56 CASES
    6-36 MONTHS, 442 CASES   (AFTER PETERMAN)

ENCEPHALITIS
    0- 1 month
    1- 6 months
    6-36 months
    3-10 years
    10-16 years

OTHER CAUSES
    0- 1 month
    1- 6 months
    6-36 months
    3-10 years
    10-16 years

PER CENT 0   5   10   15   20

FIG. 9. Etiological distribution of childhood convulsions by age groups.

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tributal to cerebral injury. Only 3 cases proved to be idiopathic epilepsy. In the *1-6 months group*, two-fifths of the cases were due to acute infection; one-fifth to cerebral injury; less than one-fifth to spasmophilia or tetany. Only 5 cases were classed as essential epilepsy. In the *6-36 months group*, infections account for two-fifths of the cases, essential epilepsy rising to 15 per cent. In the *3-10 years group*, essential epilepsy again accounts for two-fifths of the cases; in the *10-16 years group* for two-thirds. These age frequencies furnish a guide to diagnosis. They mean that convulsions in later childhood are more serious than those of early childhood.

§ 2. The Diagnosis of Epilepsy

Epilepsy is a chronic convulsive disorder in a previously normal child; it is characterized by recurring seizures, marked or mild, which may interrupt or alter consciousness. The frequency, type and severity of seizures vary enormously.

The grand mal is a major seizure with generalized clonic and tonic convulsions, cyanosis and loss of consciousness. The petit mal is a minor seizure, a momentary lapse of consciousness with perhaps pallor and staring or a peculiar facial expression. In a young child it may be so mild as to escape notice altogether. It signifies, however, an acute increase of electrical potential in the cerebral cortex. A psychic equivalent is also a form of epileptic attack, following or replacing the more usual type of seizure. It consists of more or less abrupt emotional states and episodes in which the child acts in a silly, dazed, or violent manner. In myoclonic epilepsy one or more extremities jerk suddenly without alteration of consciousness. Patients may show both major and minor forms, or major and myoclonic forms, etc.

The electrical potentials of the brain have been extensively studied by means of electroencephalography, whereby the potentials from various parts of the cortex are electrically amplified and recorded. The patterned tracings which are obtained show serial waves which are analyzed by rate and conformation. There are distinct patterns for the various types of epileptic seizures, if the tracing is taken during a seizure. Between attacks the differentiations are somewhat less clear-cut.

The accompanying chart (1/3 actual size) classifies the various types of electroencephalic records (EEG) which are commonly seen. The upper 5 tracings and the lower 4 tracings are considered abnormal, lines 1, 2, 3, 8, and 9 extremely suggestive of epilepsy, tracings 4 and 7 "suggestive" of epilepsy; tracings 5 and 6 "consistent with" a diagnosis of epilepsy. This classification is based on work with normal and epileptic adults. Children tend to show slower rates, and the standards for children are not yet fully established.*

The EEG is to be regarded as confirmatory or contributory evidence and is always to be correlated with the disease history, the physical and behavioral findings, and the family history. A painstaking inquiry into the family background will often bring to light a history of convulsions which had been considered insignificant or irrelevant. EEG records of parents of epileptic children show a high percentage of abnormal records even when the parents have always been symptom-free. Such evidence is valuable in establishing a diagnosis of essential idiopathic epilepsy.

We have reserved the term epilepsy for those children with originally intact mentality in whom the etiological factors are obscure and in whom the course is chronic without, however, necessarily depressing the rate of development. In our experience with young epileptics they tend to develop relatively normally. This fact deserves emphasis: the developmental outlook in epilepsy is usually good and the patient can, as child and as adult, lead a relatively normal life. It is important to control the seizures, for the patient's comfort and safety, and to prevent, if possible, the mental deteriora-

* In a personal communication, F. A. and E. L. Gibbs present a table of AGE ADJUSTMENTS which is designed to make EEG classification apply to various ages as follows:

Paroxysmal	Abnormal at any age
Focal (slow or fast)	Abnormal at any age
Definite asymmetry	Abnormal at any age
Very fast	Abnormal at any age
Excessively slow	Abnormal at any age
Very slow { extreme	Abnormal after 2nd year
Very slow { moderate	Abnormal after 6th year
Very slow { mild	Abnormal after 10th year
Slow	Abnormal after 19th year
Fast	Abnormal after 40th year

FIG. 10. Chart of electroencephalogram.
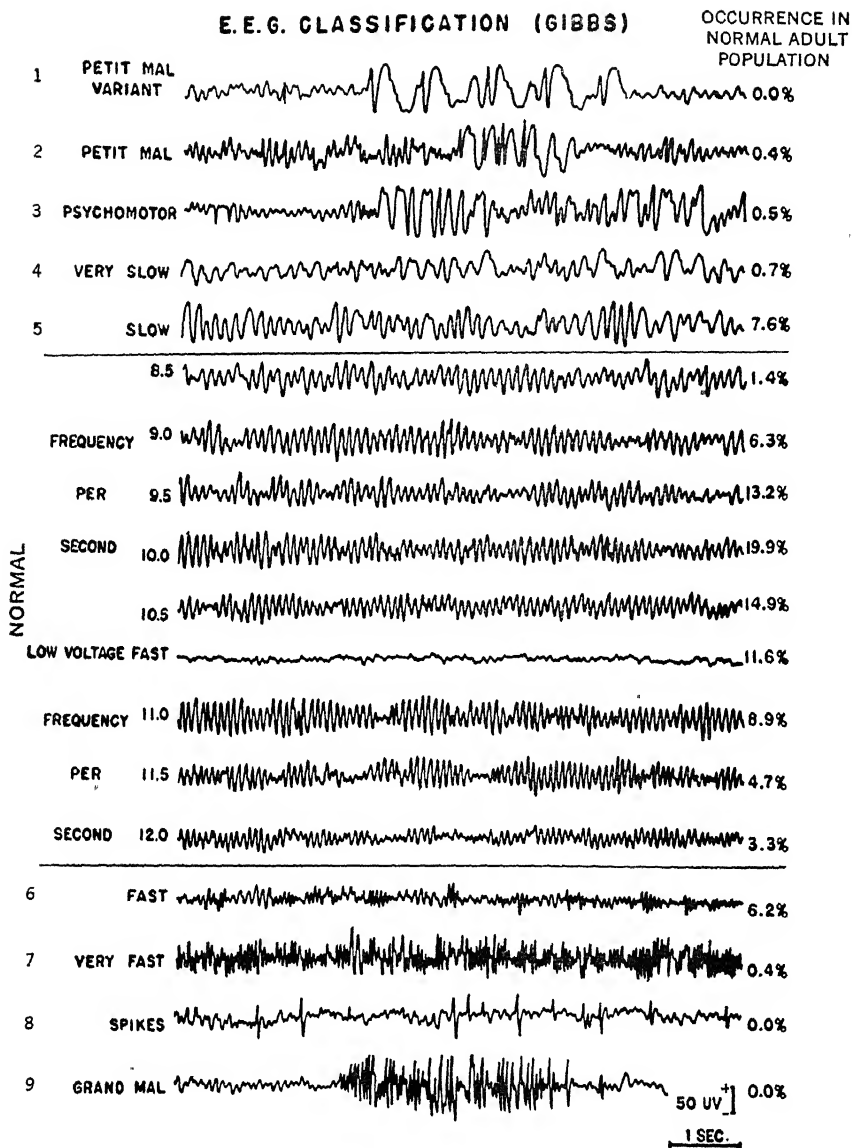
FIG. 10. EEG Classification.

tion that may occur if convulsions are allowed to recur unchecked. The EEG is useful in evaluating the efficacy of treatment with anti-convulsant drugs. In favorable cases, seizures are suppressed completely and the EEG record becomes normal. In other instances the frequency and severity of attacks are greatly reduced.

Mental deterioration does, however, occur in a small percentage of cases, in spite of treatment. The mechanism is not clear in all instances. In severe convulsions, the respiratory muscles are involved with cyanosis and anoxia; intracranial pressure is elevated and hemorrhages into the brain substance may result. Less understandable is the deterioration which is almost invariable in myoclonic epilepsy in young children and which occurs very early in the disease, or the deterioration that may follow showers of petit mal attacks.

The degree of deterioration varies greatly, from a mild dulling of intelligence to profound amentia. The diagnosis of serious mental deterioration with all its implications for the child's future, should be made with the greatest caution. It should not be predicted on the bases of pneumoencephalographic evidence of cortical atrophy, so-called, in young epileptics. In a series of 10 cases with idiopathic epilepsy, 8 were judged to show cortical atrophy by pneumoencephalographic examination; only 1 deteriorated and he had almost continuous uncontrollable seizures for 3 years; all the rest have made normal developmental progress. Mental deterioration should not be diagnosed on the basis of a developmental examination made within a week of a serious seizure episode as the child may still be in a postconvulsive confused state from which he may fully recover. We have seen remarkable recoveries of this sort take place.

In general the attitude of the family of an epileptic child should be one of intelligent optimism. The parents must become informed about the disease and its problems. They should teach the child to live with his disease and they should know of the resources for help that are available.

§ 3. CONVULSIONS DUE TO OTHER CAUSES

Although the young infant has a higher threshold of cortical discharge he is much more susceptible to convulsions than the older

child or adult, due probably to the immaturity of his nervous system. The young child has convulsions more frequently and often they are due to far less serious causes than in older children. But, even so, there is no reason to regard a convulsion lightly; the cause may be serious; the result may be serious. The cause may be amenable to treatment and the outcome serious if untreated.

The more common conditions associated with convulsions which ordinarily respond to treatment are infectious diseases, tetany, meningitis, subdural hematomas, and lead encephalopathy. Today the treatment of virus encephalitis is not highly successful and the sequelae in infants are often devastating. Convulsions associated with cerebral malformations and aplasias are but another sign or symptom of a seriously defective nervous system. The number and severity of the convulsions can often be reduced but the basic condition remains unchanged.

Seizures in the neonatal period are highly suggestive of cerebral injury, and when they occur or recur in a child with cerebral palsy they tend to increase the damage and darken the developmental outlook. Focal or Jacksonian seizures are occasioned by electrical discharges from a definitely localized lesion of the cortex and result in localized muscular spasms; a generalized convulsion may ensue. Operative removal of the offending area is occasionally successful in eliminating attacks. Another condition in early childhood associated with convulsions in which surgery is of value is subdural hematoma; surgery is not, unfortunately, the cure-all for developmental disorders in childhood that the uninformed laity believes it is.

An occasional infant is encountered with convulsions as a major sign in whom a diagnosis of cerebral degenerative disease is inescapable. In a typical case, the birth is normal and at term. There may be a history of a single convulsion in the neonatal period but in many, if not most instances the neonatal history is entirely normal. In the ensuing few months the infant does well, begins to smile, coo, laugh, play with his hands and with a rattle, engage in social play and in general is described by his parents as being alert and reactive. Then at the age of 3 or 4 months, occasionally as late as 6 months, convulsions begin. They are mild and brief, but frequent, from 4-5 to 10-30 daily; within a week or two of the onset of

convulsions, behavior regresses markedly and the infant is either inert and unresponsive or irritable and equally unresponsive. Pneumoencephalogram shows marked cortical atrophy, the EEG is diffusely abnormal. Convulsions continue for a year or two, gradually becoming less frequent, and the child makes no further developmental progress. The disease is not fatal, and in our experience is not familial.

At the lower end of the seizure gradient lie "febrile" convulsions. They occur in susceptible, usually somewhat unstable children under 3 years of age, in association with temperature elevations. A small but significant number of these children eventually prove to have true epilepsy.

Convulsions are never insignificant and even when an obvious cause is discovered, it cannot always be accepted at face value (see Cases Nos. 8, 9). Some caution should be exercised therefore, in predicting the course or outcome, and in dismissing the possibility of epilepsy too readily. The developmental outlook must be based upon a critical estimate of history, age factors, etiological factors, evidence or absence of evidence of cerebral damage, electroencephalographic findings, and of the developmental status and course.

§ 4. ILLUSTRATIVE CASE SKETCHES

The following brief case citations are presented to illustrate some of the conditions under which convulsions occur and their differential prognostic significance.

Pyrexia

CASE 1 was always a fussy, colicky baby and a feeding problem. Would only eat when falling asleep. At 15 months had a mild upper respiratory infection with temperature of 103° F., major convulsion with cyanosis and loss of consciousnes. Developmental status at *15 months:* High average; EEG moderately slow.

No family history of seizures, mother's EEG moderately abnormal, fast and slow; father's EEG normal. Child is unstable and possibly a potential epileptic. She has had no further seizures to age 3½ years.

CASE 2 did well until the age of 3 years when, in association with a viral infection, temperature 104° F., she had a severe generalized convulsion. Developmental status at *4½ years:* High average; EEG within normal limits.

The father had convulsions in childhood and has a moderately slow EEG. Mother's history negative and EEG normal. Child is alert, competent with an engaging and amusing personality; no evidences of instability. Her chances of escaping epilepsy would seem better than Case 1.

Toxic Factors: Damaging Effect of Convulsions

CASE 3 has an inferior heredity. At 40 weeks she sustained first and second degree burns of the left arm and right leg with intermittent convulsions for two days, followed by a right hemiplegia. Developmental status of *56 weeks* and *21 months:* Dull normal. There are only slight residuals of the hemiplegia.

This child probably constitutionally somewhat inferior. The convulsions were toxic in origin; the hemiplegia was due to cerebral hemorrhage during a convulsive seizure. There is no evidence that she is epileptic.

Trauma—Jacksonian Epilepsy

CASE 4 had a congenital hemangioma over the right side of the face and scalp. At 23 weeks she sustained a fracture of the frontal bone, followed by left hemiplegia, partial homonymous hemianopsia of left visual field, and recurrent left-sided fits. Developmental status at *42 weeks,* at *12* and *24 months:* Consistently low average.

The hemangiomia probably also involves the meninges over the right cortex. Trauma to the head caused hemorrhage into the cortex. There are also some suggestions of personality damage.

Myoclonic Epilepsy with Deterioration

CASE 5 did well until 5 months of age when he began having attacks of jerking of the arms, 5-6 times within 2-3 minutes; 10 attacks in 4 weeks. At 6 months physical, neurological, and developmental examinations all normal. EEG showed slow spike, and spike and wave activity, indicative of a convulsive disorder. It proved difficult to suppress attacks with anti-convulsant therapy but none occurred after 21 months. Development was slow and he became difficult to manage. At 3 years he was so disorganized as to seem demented; an active, excitable, obsessive, destructive boy who left the examining room a shambles. Developmental status at *36 months:* Imbecile.

The father had convulsions in infancy. Both parents now have normal EEG records.

In our experience with myoclonic epilepsy in young children, rapid deterioration practically always occurs.

Petit Mal Epilepsy

CASE 6 at 1 year of age began having brief sudden attacks of falling while sitting, recovering immediately and seemingly unaware that anything had happened. Attacks came in frequent showers until they were controlled at 18 months.

Developmental progress: At *55 weeks* (3 weeks after onset), maturity at 48 weeks, within normal limits. At *15 months* (still having frequent attacks daily), level 48 weeks, no progress. EEG showed diffuse petit mal waves, pneumoencephalogram showed "cortical atrophy." At *21 months* (attacks under control), maturity 18 months. At *5 years* (1 or 2 minor seizures a year), I.Q. 90. Doing well.

This case illustrates normal development in a girl with petit mal and a pneumoencephalographic diagnosis of cortical atrophy! Her poor showing at 15 months is attributed to the fact that she was then having numerous daily attacks. A valid prognosis could not be made until the seizures were controlled. She then showed a remarkable recovery of developmental momentum.

Psychomotor Epilepsy

CASE 7. An illegitimate child referred to the clinic for adoption study. The mother was said to have an I.Q. of 53 and to be epileptic, possibly due to encephalitis. Developmental status at *48 weeks*: Average. Inhibited, behavior shows much scattering; motor 60 weeks, adaptive 44+, language 56, personal-social 52 weeks. At *21 months* having many temper tantrums. Maturity level *21 months.* Foster parents wish to adopt her eventually but are not yet ready to do so. At *5 years,* temper tantrums and unreasonable behavior episodes have continued and foster mother can predict episode by facial expression and "look in eyes." An attack just before her clinic visit started over placing a bobby pin in her hair; she did not want it where it was placed, but on the other side. When it was moved, that angered her and she demanded the first place again, finally going into a violent tantrum lasting over an hour. On recovery did not recall the episode and had no interest in where her bobby pins were. At the clinic she made an excellent social adjustment and displayed mature, composed behavior. I.Q. 114; EEG abnormally fast, consistent with epilepsy.

Fortunately this child was not placed in adoption in infancy. Her present foster parents accept and understand her difficulties and are cooperating with treatment. They consider her as their own but have brought no pressure to adopt.

Essential Idiopathic Epilepsy

CASE 8 had his first convulsion at the age of 2 years and has had 26 grand mal seizures in the ensuing 2 years. The convulsions are reported as occurring with mumps, teething, tonsillitis, a "cold," temperature 102° F., temperature 100°; the final 11 convulsions were not associated with any illness. The only illness he ever had without convulsing was pertussis. The EEG is abnormally fast with a left temporal spike focus. Pneumo-encephalography is indeterminate. No major seizures since dilantin therapy was begun but minor attacks occur frequently. His paternal grandmother has convulsions, his mother has migraine. Developmental status at *4 years and 3 months*: High Average. The only abnormalities are a moderate general overactivity and a fairly marked tremor of the hands.

Normal progress in an epileptic boy despite numerous major seizures. Of interest is the deceptive onset; early in the course of the disease seizures were always associated with illness and fever, only later did they become "idiopathic." It is now important to suppress his minor attacks.

Essential Idiopathic Epilepsy with Deterioration

CASE 9 was vaccinated at the age of 2½ years; 10 days later he had severe convulsions and was hospitalized. Two cells were found in the cerebrospinal fluid and a diagnosis of vaccinal encephalitis was postulated. Convulsions recurred about once a month with therapy to the age of 4 years, ceased altogether for a year. Then began having infrequent minor attacks, rare major seizures.

Developmental progress: At *38 months*, silly, overactive, poor attention. Maturity—18-24 months. At *51 months*, quiet and cooperative: maturity—27-30 months. At *60 months*, maturity—27-36 months. EEG very abnormal, with petit mal waves. At *6 years*, maturity—33-42 months. Institutionalized.

An erroneous diagnosis of vaccinal encephalitis was made (on very little evidence) in this case. His first seizure was probably precipitated by his systemic reaction to vaccination but any other condition causing a febrile reaction would have had the same effect. And even without a febrile precipitator he would have eventually developed his epilepsy.

Cerebral Palsy—Deterioration

CASE 10 had a difficult birth and his head was deformed at birth. He had a single convulsion at 15 weeks. He developed slowly during the first year and had a mixed spastic and athetotic palsy. In spite of the

fairly serious motor handicap and considerable evidence of an unstable personality make-up, development proceeded fairly normally during the first few years. Developmental status at *18, 21,* and again at *45 months:* Low average. Beginning at about 4 years he has had repeated convulsions and has become more and more difficult and unmanageable. Developmental status at *5 years 9 months:* Moron.

This boy is caught in a vicious circle: brain injury causing convulsions, causing further brain injury, causing further convulsions. Recurrent convulsions in children with cerebral palsy are nearly always of very serious import.

CHAPTER XI

THE NEUROLOGICAL DIAGNOSIS OF INFANT BEHAVIOR

An examination of infant behavior is essentially an examination of the central nervous system. We may use this examination primarily to determine the maturity status of the infant. But we use the self-same examination to discover the presence of specific lesions and disease in the nervous system. The developmental examination then becomes part and parcel of a neurological survey. It is particularly useful during the period of infancy, because so many of the ordinary neurological tests are suitable only for older ages.

The developmental and neurological objectives of the examination cannot and indeed should not be divorced. First of all the infant's behavior must be surveyed and appraised in terms of his calendar age. This behavior may prove to be normal or it may show simple retardation. Or it may show deviations which are so distinctive that they point to faults in neural structure and to impairments in neuro-motor functioning.

The developmental examination is designed to keep the infant in an optimal state of response. This brings out characteristic reactions which would not be forthcoming at all through more artificial procedures. The developmental behavior tests lay the infant open to opportunistic observation. They call into play the organs of vision, hearing, touch, and proprioception. They make a wide range of demands upon motor co-ordination; and inevitably call into requisition the higher cortical controls. For these very reasons they can be advantageously adapted and utilized to serve the purpose of a neurological examination.

The primary function of the developmental tests is to establish

the basic maturity of the infant in the four major fields of behavior. A maturity appraisal is an essential part of a neurological diagnosis when the patient is an infant or young child, but a clinical distinction must be drawn between signs of normal immaturity and of neurological dysfunction. The distinction rests upon a normative appraisal of the child's behavior patterns. There are no more sensitive indicators of underlying neural structure and of neurone activity than the child's spontaneous reactions to the demands of the test situations. The developmental approach being systematic in scope and procedure insures a complete survey of behavior equipment and behavior efficiency. And what is a neurological examination but an investigation of the nervous system as the generator and machine of behavior?

The nervous system is a machine but it is a growing machine. Postural behavior, in a broad sense, is the most fundamental concept for interpreting the integrity of the machine and the efficiency of its operation. All co-ordinations, both gross and fine, imply postural adjustments—that is, adjustments of the organism as a whole to its environing conditions. Locomotion is a dynamic, repetitive projection of posture. Prehension and manipulation consist of closely knit series of postural adjustments. Even eyes and fingers assume postural sets.

Postural sets are neuro-motor fixations by means of which the child achieves station, balance, stance, steadiness, and preparatory poise. Postural set may issue in overt movement, and it is itself a form of action because it requires active counterbalancing inhibitions. With complete muscular relaxation, postural set dissolves. Postural set and movement patterns are so closely related that most sensori-motor reactions should be clinically envisaged in terms of posture.

Motor behavior develops from the beginning by the expansion of a total reaction system and by the individuation of specific patterns within this system. Thumb opposition, for example, is a pattern of this kind. As it emerges it also becomes incorporated into the basic postural sets which make up the total reaction system. Earlier in the life of the infant the function of thumb opposition was altogether lacking; in its incipient stage it was manifested in an imperfect, sporadic manner; its execution was dependent upon a few favorable and accessory postural attitudes; later it became independent

of these limitations and responsive to a wide diversity of postural sets. Such relative emancipation (individuation) combined with obedience to the total reaction system marks the maturity of a growing function.

All the movement patterns of the infant are constantly undergoing developmental organization similar to that just outlined. The clinical appraisal of any motor function must take into account the developmental status of that function in relation to age and maturity. The genetic steps in the normal development of a function are summed up in the following schematic gradient:

0. *Pre-nascent stage.* Complete absence of function.

1. *Nascent stage.* Imperfect, inadequate, sporadic manifestation of the function in loose and variable associations with several postural sets.

2. *Assimilative stage.* More positive performance of function which, however, is dependent upon particular postural sets, and accessory reinforcing postural attitudes.

3. *Co-ordinating stage.* Perfected performance limited to these particular postural sets but with sloughing off of the accessory postural attitudes, previously necessary.

4. *Stage of synergic individuation.* Independence from restricted postural sets; versatile performance smoothly synergized with numerous and varied postural sets.

These categories enable us to differentiate normal physiological awkwardness from neuropathological awkwardness. The normal infant, *qua* infant, is not to be regarded as awkward. He is awkward only with respect to a very new function while it is in a nascent, or assimilative stage. He has an extensive array of established functions which are executed with grace and facility. Indeed, the year old infant in numerous motor skills already approximates the adeptness of the adult. Skill is a decidedly relative concept especially in infancy. An infant may be crude in digital co-ordination, but expert in manual manipulation; he may be crude in manual movements, but expert in eye movements. Normally he is skilful in the functions which are part and parcel of his established maturity.

Neurological dysfunction is not always based on sheer absence or even impairment of specific structures; it may be due to a lack of functional correlation and of synergy between structures which are

relatively intact. The facile operation of the nervous system depends upon balance and counteraction between antagonistic components. The function of the sympathetic division, for example, is generally antagonistic to that of the parasympathetic. Extensors are antagonistic to flexors; excessive dominance of one disturbs their normal counterpoised relationship and produces neurological symptoms. Bilateral, unilateral, ipsilateral and contralateral members must be brought into parallel and diagonal co-ordination. This is accomplished through a kind of cross-stitching or reciprocal interweaving in the structural growth of the networks of the nervous system. Disturbance of the regulative growth factors or damage to the normal lines of communication in these networks produces asynergies and dysharmonies which constitute an important group of neurological symptoms. Excessive individuation of behavior patterns accounts for yet another group of symptoms, some of which go beyond neurological confines and reach a psychiatric level in compulsive action.

The organization of the infant's sensori-motor behavior, that is to say his integrated total pattern, proceeds from head to foot. We shall bear in mind that he does not develop on the installment plan, but always by the expansion of the unitary reaction system. Yet it is not a homogeneous balloon-like expansion nor a hierarchical stratification. Rather it is a process of reincorporation and consolidation with progressive corticalization. The neurological result is an interwoven structured texture which expresses itself in progressive patterns of behavior.

The following paragraphs outline the progressive organization of neuro-motor functions. This outline is concerned with functional mechanisms and relationships. It is an interpretive statement of the neuro-developmental significance of the sensori-motor patterns which come within the scope of clinical neurology. Such a survey of the developmental organization of neuro-motor functions will serve to explain the nature of abnormal neuro-motor signs and symptoms.

§ 1. The Developmental Organization of Neuro-Motor Patterns

Head. The newborn infant may display considerable rotary head activity in the supine position. The predominating position of the head, however, is rotation to one side. This position evokes the tonic

neck reflex posture of the arms. At about 16 weeks the midposition of the head predominates with related symmetrical arm postures and activities. By 24 weeks, head and arm postures have become relatively dissociated. The infant can turn the head without altering arm attitudes or he can use the arms asymmetrically with the head in the midposition.

Erection of the head against the forces of gravity requires co-ordinations, tonal distributions, and sustaining powers that the newborn lacks. The first head liftings are fleeting and wobbly and require outside bracing of the back (as when he is held at the shoulder) or a favorable position (prone) for employing the extensors of the back as well as those of the neck. The wobbling and plunging of the head, with only momentary erection, is superseded by more sustained erection with fine rhythmic nodding or bobbing (12 weeks). At 16 weeks, if the head be thrust forward slightly, accessory neck muscles are brought into play to assist the extensors, and a steady, erect, but forward position can be maintained. Rotation of the head in this position may disturb the newly acquired equilibrium so that the head may plunge sharply. By 24 weeks, the head can be maintained freely erect, and can be freely rotated. The maintenance of head station is fully established; it has become more or less effortless and automatic.

Eyes. Ocular fixation, perception and pursuit are readily observed in the dangling ring situation and more or less in all situations which bring the eyes into requisition. Fixation and perception are at best vague in the newborn and ocular pursuit is fleeting. Objects are as a rule unperceived unless directly in the line of vision, and then they must be moving, or massive, or they must offer a distinct contrast to the surroundings. The infant is particularly prone to stare vaguely at lights and light-masses such as windows.

Definite fixation, with convergence, focus, and shifting of focus, begins to appear at about 8 weeks of age. Over-convergence (strabismus) is frequent at this age, because the ocular muscles are still used disco-ordinately. Visual following of a moving object is jerky, the eyes move too slowly to keep up, or move faster than the object, and so it is frequently lost. But the infant is extremely alert to moving objects. By 12 to 16 weeks convergence and focusing are

fairly accurately performed and following is smooth and well co-ordinated. Visual acuity is well enough developed so that an object as small as the pellet is perceived and may be inspected with absorbed interest. By 24 weeks, the child has sufficient voluntary command of eye muscles to maintain fixation on a stationary object, if he so desires, even in the presence of a competing moving stimulus such as the examiner's withdrawing hand.

After this mastery of the basic ocular movements, eye behavior is closely bound up with the development of visual perception, which however is always dependent upon kinesthetic cues. By progressive stages the infant learns to identify forms, and to associate the visual experience of objects with the visual experience of representations of objects (15-18 months). It takes five years more of maturity and experience before he is ready to discriminate the word symbols for objects and to follow a whole procession of such symbols across the printed page. These achievements are based on postural adjustments involving eyes, head and hands.

Mouth. In the normal newborn the sucking and swallowing reflexes are usually well developed. Early awkwardness in feeding shows itself in too precipitate sucking (before the nipple is in the mouth) so that the tongue cleaves to the palate, drawing the lower lip in with the nipple, imperfect approximation of the lips with leaking from the corners of the mouth, inability to release a deflated rubber nipple, occasional choking, and considerable air swallowing during feeding.

By 16 weeks the infant opens the mouth adaptively and awaits the insertion of the nipple; he closes his lips securely about it and permits a collapsed rubber nipple to reinflate.

When semi-solid foods are first offered, sucking movements of the tongue are initiated with elevation of the posterior part of the tongue; the food is ejected with the tongue in pursuit. He may choke on food that reaches the pharynx. By 28 weeks co-ordination of tongue and pharynx has so advanced that there is no further difficulty in handling puréed food. At this same age the infant begins to co-ordinate his feeding performance with his nascent capacity to sit, and to grasp.

Biting begins to take the place of mouthing in the child's exploi-

tive play as well as in feeding situations. By 32 weeks he can bite off a piece of cracker, munch and swallow it in a sophisticated manner. Air swallowing has ceased to cause any difficulties.

Control of salivary overflow begins to improve at 40 weeks with increased tonicity and command of lips, tongue and jaws, so that drooling practically disappears by the end of the first year. He begins to drink from a cup. Oral patterns become more or less restricted to the feeding situation at about this same time; toys and hands, except when thumb sucking is a persistent pattern, go less frequently to the mouth.

By 18 months, with the acquisition of well-defined chewing, oral patterns are fairly well differentiated and co-ordinated. The child needs only to integrate these patterns with his manual-adaptive behavior (self-feeding) and with social requirements (table manners).

Arms and Hands. (a) Prehensory approach is readily observed in numerous situations in which objects are offered within the child's reach both in the supine and in the sitting positions. Reaching responses make their first appearance in the normal infant at about the age of 16 weeks. They are then poorly differentiated, poorly co-ordinated, and poorly directed. Both arms become active, but are as likely to be withdrawn or to extend laterally as to approach the midline; if the midline is approached, flexion is apt to be so predominant that the hands come to the mouth and lack the necessary extension to reach out toward the object. The sitting position reveals the tendency of the whole body to be involved in the response, so that forward leaning of head and trunk, projection of lips and tongue, eye widening, and flexion of the legs accompany the arm activity. Or sitting at this age may place the child in such an unaccustomed position in relation to the forces of gravity that he may be unable to release the approach mechanisms which he displays in the supine position.

With increasing age and perfection of cortical control, approach becomes more prompt, better differentiated, smoothly performed and directed. By 28 weeks one arm leads in approach, the movements of the other being partly or completely suppressed. Now approach and prehensory appropriation are one.

(b) Grasping also goes through numerous well defined stages. The neonatal hand is closed. The first requisite for grasp is an open hand; the hand must then close around the object and maintain that closure. The act requires co-ordinated interaction between flexors and extensors. Early grasping is whole-handed or palmar and even includes flexion of the wrist. The grasp then shifts to the radial side of the hand (radial palmar) and later becomes a function of fingers rather than hand (digital). Special differentiation of thumb and index for precise fine prehension appears in the last quarter of the first year.

(c) Finesse and diversity in manipulation depend on maturational factors and on the integrity of neuro-motor equipment. Early manipulatory patterns are simple and somewhat clumsily executed. Growth trends in manual exploitation go through rapid, successive, cumulative stages of development: Simple regard for an object in hand, mouthing, shaking, banging, transfer from hand to hand, matching two objects, putting one object in another, putting one object on another, aligning objects, fitting objects together and other more elaborate combinations. All these acts have a large adaptive component, but the neuro-motor elements are obviously of almost equal importance. Precise manipulations of increasing complexity require co-ordinations of increasing precision and complexity. With each new function the child shows this newness by awkwardness in execution; with the integration of each new function into the action pattern system, the child shows facility and expertness.

(d) Release, as opposed to dropping, normally appears in the last quarter of the first year. In succeeding months it becomes more precise, better timed and it is combined with grasp, exploitation and placement; the child releases at the correct moment in the correct place. When 18 months old he can release a cube in fair alignment on top of a tower of 2-3 cubes without knocking down the tower. When manual release is well co-ordinated with arm movements, projected placement or throwing with some accuracy of aim is possible. He must also integrate release with stance and postural attitude. The 15-month-old child, for example, cannot throw a ball without falling down; he sits to throw. Not until he is 18 months old can he throw a ball from the standing position.

Trunk, Legs and Feet. We have just traced the organization of arm and hand activities in the development of their specialized functions of prehension and manipulation. Trunk, legs, and feet also have specialized functions, those of body posture and locomotion. The ultimate goal of their development is independent bipedal walking in the upright position. This is the framework on which all more complex gross motor skills such as running, climbing, skipping, skating, bicycle riding, dancing, etc., depend.

Development in the human infant is orderly; it is, however, not necessarily so orderly that he achieves one function in its perfection and then develops another which he appends to the first. Two functions which are to be integrated tend to develop almost simultaneously, at first apparently unrelated to each other, first one then the other taking lead and precedence. They seem to weave in and about each other as they develop, until they finally merge, synergize, coordinate. It is a reciprocal kind of interweaving. So it is with the development of upright posture and locomotion.

The achievement of the erect head station is the first step in the assumption of the upright posture. In broad outline the succeeding steps are sitting, creeping, standing, and finally walking.

(a) *Sitting.* At the earlier ages, trunk and legs are passive in the supported sitting position; the back is bowed, the legs flexed. By 16 weeks the infant holds the head erect, though not perfectly so, and he begins to evince some pleasure in propped sitting. At this same time both the thoracic and the cervical spine participate actively in the erect posture and only the lumbar region is passively bowed. By 24 weeks the infant can lift the head from the supine position as though straining to sit. By 28 weeks he maintains the passive sitting position for a brief period without support. He sits on an ample triangular base with the legs flexed and widely abducted for lateral support and leans forward to insure anteroposterior balance. He may even use his hands as accessory forward props. Lifting his arms, he begins to master forward balance. Sitting more erect with a straight back, he ventures into the problem of backward balance. Before he has quite mastered the art, he may fall backwards (36 weeks). With the acquisition of anteroposterior balance, he begins to narrow his sitting base, semiextending and semiadducting the legs. When lateral balance, relatively independent of leg pos-

ture, has been achieved he is a free and able sitter (40 weeks). He can lean forward and turn to the side within his sitting posture. A little later he can pivot and hitch, or translocate within that posture. The hands and arms have been freed for manipulatory duty, eyes have been elevated to a commanding position.

(b) *Creeping*. The progressive patterns of postural attitude and activity which the infant displays in the prone position may properly be regarded as stages in the development of locomotion. Over a score of such stages have been identified for the entire ontogenetic sequence, and they illustrate the principle of reciprocal interweaving with such nicety that they are given in full in the accompanying diagram (Figure 11). The first column lists the stages in which flexor components predominate; the second column lists the stages in which extensor components predominate.

The cephalo-caudad and integrative trends in the development of prone posture merit notice. In the earliest weeks the infant is peculiarly helpless in the prone position. Because head and arm responses are so poorly developed he tends to pitch forward on his head. The legs are comparatively free and engage in reflexive, alternating, crawling movements. Elevation of the head and upper part of the chest is well developed by 16 weeks and at this time the legs are relatively inactive. By 20 weeks he props up on his extended arms, rearing the head and chest well above the supporting surface. Four weeks later he can roll from the supine into the prone position with considerable agility. This is the child's first successful voluntary change of positional orientation.

By 32 weeks alternating, co-ordinated flexions and extensions of arms and legs result in effective circular pivoting. This is the first successful voluntary change of positional orientation that requires alternating co-ordinations. Crawling (dragging the body along the supporting surface by co-ordinated action of arms and legs) develops directly from pivoting.

In the next stage the trunk is elevated and the infant assumes the creeping position (36 weeks). At first he must maintain the static posture of all four extremities simply to hold this position; any movement results in ignominious collapse. But by 40 weeks he has combined his alternating co-ordinations with mastery of balance and he creeps on hands and knees. At the same time he integrates his

FLEXOR DOMINANCE   EXTENSOR DOMINANCE

Passive kneel position

           Passive leg extension

Active kneel position

           Active leg extension

One knee thrusting

           Alternate extensor kicking

Abducted one knee thrusting

           Swimming

Simultaneous low creep position

           Frogging

Advanced one knee thrust
Same with foot eversion

           Pivoting

Inferior low creep position
.

           Backward crawling

Low creep position

           Crawling

High creep position

           Backward creeping

Rocking

           Creep-crawling

Creeping
Near step with one foot

           Creeping, step with one foot
           Plantigrade quadrupedal position
           Plantigrade quadrupedal progression
           Bipedal standing
           Walking

FIG. 11. Developmental stages in the patterning of prone behavior, showing reciprocal interweaving of flexor and extensor dominance.

prone and sitting abilities; he can scramble over into prone from the sitting position, creep expertly and then sit up again. He can now move about under his own power, take himself where he wishes to go, pursue and secure remote objects. He also shows a tendency to creep on hands and soles, instead of hands and knees. This plantigrade stance is the final transition to upright posture. It puts him in a position to stand erect and to walk on two feet.

(c) *Standing and walking*. The earliest positive response to the supported standing position is seen at 12 weeks when there is some active leg extension with brief, partial assumption of weight, and repeated lifting of one foot. Not until 28 weeks does the infant assume any large fraction of his weight. He delights in this new ability and exercises it by active bouncing, alternately relaxing and extending his legs with an active thrust against the supporting surface. By 32 weeks he tends to maintain active extension of the legs, hips and trunk; posture is sufficiently stabilized so that he can stand briefly, supported only by the hands. In another four weeks he uses his own hands to maintain this posture, and can stand holding onto the railing of his crib or play pen. Here is the assimilative stage— a rigid fixed posture can be held (not assumed) with accessory use of the arms. Movement is incompatible with maintenance of posture, but the child is experimenting with and developing balance.

By 40 weeks he plants his feet wide apart, and stands on a broad base. Balance and control have been sufficiently incorporated into the standing act so that he can co-ordinate it with his newly acquired ability to sit. He can pull himself from the sitting position, by the combined integrated action of arms and legs, to a standing position (still holding on) and he can lower himself again.

Independent, co-ordinate action of the legs, combined with maintenance of the upright posture and balance is yet to be achieved. At 44 weeks he begins to lift and replace one foot. By 48 weeks he can walk (when both hands are held) with co-ordinated, alternating leg action and some forward drive; he can also cruise; that is to say he can walk sideways, abducting one leg, bringing the other to it, shifting the hands first one, then the other, at the same time. In this manner the infant walks about his crib, his play pen, and about the furniture in the room. By the age of 1 year he is so versed that he prefers to have only one hand supported when he walks, leaving

the other free to carry, reach, and touch. At 56 weeks he "forgets" to hold on as he stands in his play pen, and he stands alone briefly.

He is now ready to walk. His first independent steps are propulsive; he lunges forward a few steps into his mother's arms. But by 15 months he can rise to his feet independently, assume his wide stance and toddle about, stop and start again. Posture and gait are somewhat rigid and easily upset. He falls by sitting down suddenly but maintaining his balance. Further progressive stages entail the acquisition of smoothness, speed, and versatility. The rigidity, propulsiveness, awkwardness, falling, wide stance, etc. are gradually sloughed as the function is perfected. Running first appears at 2 years, and at this same age he can kick a ball by swinging his foot against it without capsizing. He is 3 years old before he can stand on one foot even momentarily.

Walking can be retarded by lack of opportunity for practice, by bad falls, by sickness, etc., and it can be a little accelerated by practice and training. But the normal child does not need to be taught to walk. The urge to assume the upright posture and then to step forth is part of development, and it is an essential part of normal development, opening new vistas and horizons, bringing the child into new relationships with his surroundings, and giving him a new sense of power and achievement.

Sphincters. The excretory functions are controlled by a complex combination of voluntary and involuntary mechanisms. Action of the sympathetic nervous system involuntarily maintains the urethral and anal sphincters in tonic contraction when bladder and bowel are empty or only partially filled. When a certain threshold in bowel and bladder content is reached, (this threshold varying greatly from individual to individual and in a given individual under different conditions), the sphincter relaxes and the smooth muscle of the wall of bladder or bowel contracts, expelling the contents. Expulsion may be complete or partial, again depending on stimulus thresholds. This is the basic excretory mechanism upon which voluntary action under cerebrospinal control is superimposed. In the early weeks and months of life, it is essentially the only mechanism in operation although even in this stage accessory voluntary muscles may be called into play to assist in the act of expulsion.

What the child must acquire in order to be completely "toilet

trained" includes conscious association of the excretory act with certain internal sensations, with a particular and appropriate place, with certain words; the ability voluntarily to inhibit relaxation of the sphincters, to terminate that inhibition (to release) voluntarily, to verbalize or otherwise indicate the need, to differentiate between stimuli from bladder and bowel and to inhibit or release the appropriate sphincter, and to foresee sufficiently the urge to urinate or defecate. A formidable task, the complexities of which are not always appreciated.

The successful early toilet training that mothers boast about depends upon a conditioning process in which the child makes a very simple association between toilet seat and toilet need. The association is of such a nature that an impending excretion is released more or less promptly by the stimulus of the toilet seat; if excretion is impending and no toilet seat is provided, events take their natural course; if excretion is not impending, no results ensue from the associating stimulus. The "success" is highly dependent on the mother's timing of the associating stimulus and on a large preponderance of positive associations (full organ plus toilet seat) as opposed to negative associations (full organ minus toilet seat, or empty organ plus toilet seat). The associations break down easily under very slight alterations of conditions: an illness, a different bathroom, conflicting drives (as the development of walking), a new nursemaid or a cold day may disrupt the conditioned association. Or so many negative reactions may be built up by overzealous training as to establish a negative association: the toilet seat inhibits.

If, however, a positive association is established at a favorable period in development (around 15 months of age) the child may himself take the next step, which involves inhibiting release until the proper conditions are established for release, i.e., *waiting* with a full organ (a reasonable length of time) until the toilet seat is provided. At the same time the toilet seat and excretion in general begin to form new associations with a general *word* (18-21 months). The disengagement of the word from the act itself in point of time is another task. The word is first applied to the products after excretion, then to the process as it occurs, and only after a long developmental process to the internal sensations which precede the act When this has been accomplished the child "tells" (24 months).

First he tells after he has acted, then as he acts, then before he acts, but not soon enough, and finally he tells in good time.

Reciprocal interweaving is going on all the time in the development of this function, as it always does when antagonistic components are involved. At times inhibition takes the upper hand; then the child withholds valiantly as long as he can, and is unable to release at will. Then again release mechanisms are dominant and the ability to inhibit is overpowered. This is another example of physiological awkwardness due to immature co-ordinations.

When positive associations between excretory need, toilet, and word have been well established, time relations have been worked out and mastered, and differentiations have been made between bowel and bladder urgencies, the child must still co-ordinate these abilities with the mastery of impeding clothes. At 3 years he is beginning to free himself from dependence on adult help and reminders, and from ideal and specific conditions. At about the same time the ability to maintain inhibition of release during sleep, and to respond to the stimulus of a full bladder during sleep by awakening rather than by release is fairly well established.

All these manifestations of sphincter control are slowly acquired; lapses may occur at any time before co-ordinations are completely and permanently established (6-7 years). Indeed, the check and counter-check of progress, lapse, progress again with this break in the mechanism reinforced and strengthened, lapse in a new direction, progress with new reinforcements and so forth, is the way in which a strong, durable pattern is developed. The final pattern is fairly proof against mishap.

Ear and Larynx. In the neonatal period the infant responds with sudden startling or crying to loud sudden noises, as the ringing of the telephone, the slamming of a door, or the backfiring of a car in the street. By 6 or 7 weeks of age he accepts, more or less, the cacophony of the civilized world; at least it no longer violently disturbs his tonal or emotional equilibrium. He listens to the sounds about him, and displays transient auditory fixations by immobilization. By 24 weeks of age he is beginning to locate sound with considerable accuracy, turning his head appropriately. This response is conveniently tested by the bell-ringing situation.

The very earliest sounds the infant makes are no more than squeaks or mews. The vocal apparatus develops slowly but progressively and by 16 weeks expressive laughter is well differentiated and some of the middle vowel-sounds (ah-eh-uh) are enunciated. Squeals and crows of delight and experiment, grunts and growls of guttural quality follow. By 28 weeks the consonant *m-m* is heard, chiefly in association with crying. Clear single syllables, combining consonant and vowel, then doubling of syllables as "dada" emerge by 36 weeks. The first evidences of verbal or expressional comprehension appear at the same time when he responds correctly to his name and to "no-no," and to "come" with gesture. Vocalization has long been voluntary, but voluntary *control* is still another matter. The deliberate imitation of sounds (cough, click, razz, etc.) also first appears at 36 weeks, a critical age in the development of speech.

It is not surprising that the infant is ready with his first word (association of a definite articulated sound with a particular object, person, or action) at 40 weeks. Nor is it surprising that this first word may not sound much like the adult word, nor that its associations should be somewhat loose and variable. "Doo-doo" may perhaps mean bottle, food, eating, and even kitchen.

The first steps in language have been taken, but many more months are required to develop the necessary neuro-motor skill to articulate correctly and accurately, and with ease and diversity. Many more months are required to develop the necessary association between the sound of the thing and the thing itself, to make both associations and differentiations.

The jargon stage (13-24 months) is the period when the matrix for speech is laid down. Fluency and variety of sound combinations are developed into an incomprehensible language, more or less free-floating and non-utilitarian. Out of that matrix words and phrases crystallize (21 months). Words become tools.

Language burgeons rapidly; vocabulary increases apace; utilization finally expands to include the past, the future, the absent, and finally the abstract. Not until 4½ years do infantile pronunciations disappear completely.

Psycho-Motor Sets. Attention is the integrated expression of psycho-motor set. The patterns of attention depend on age and

maturity, on well-being and temperament, on visual, auditory and experiential factors (the novel experience commanding attention by virtue of its very novelty), and also on special individual interests. Attention thus shows great individual variation; it is usually thought of in terms of how easily or with how much difficulty it is elicited, of its incisive alertness or its vagueness, its sustained character or its brevity. These qualities, however, are very dependent on personality make-up, and to describe an attentional pattern as "long" or "vague" tells little of its maturity. Our purpose is to trace, in broad outline, the organization of psycho-motor sets.

Even in the neonatal period the infant is at times attentive. At this age he attends sensations; sensations such as a full stomach, a warm bath, or exposure to diffuse light. He shows his attention by brief immobilizations, assuming a listening postural set. His own internal sensations interest him when they are pleasant. Sights and sounds that impinge upon him, if not immoderate, interest him and he quiets to attend them.

By 6 to 8 weeks nearby moving objects begin to catch his eye, and evoke his attention. He follows moving persons and every now and then catches sight of his own hand. He begins to inspect objects that are within his near range of vision: an animated face, a toy hung on his carriage. His attentions are brief but unmistakable. By virtue of his newly acquired head and eye control he seeks new visual experience.

The acquisition of the erect head station at 12 to 16 weeks and the beginning of (propped) sitting provide new postural sensations and orientations. Attention at this time tends to be transfixed and starey. In the examination situation attention to the test materials may be somewhat difficult to elicit, partly, because of immature head and eye co-ordinations.

As head-eye control advances, the infant's visual range increases and his interests widen at the same time. Simultaneously prehensory powers are dawning. Things he sees, and he spies them promptly and expertly as they are presented on the table, become things to encompass, hold and feel. By 28 weeks the hands are so obedient that they grasp and hold objects and bring them to the infant's mouth. Everything within reach excites his interest and invites grasping, feeling, mouthing. He is accustomed to the sitting positions; mild

internal sensations are now taken for granted. In the examining situation his attention is prompt and tenacious; it is highly channelized and limited to the test object immediately in front of him.

His first attentions were chiefly internal; then they become more external but they are diffuse, more or less undifferentiated and lack versatility. By the end of the first half-year they have become *selective*, though they are still very *restricted*. He gives sustained attention to one object; if a second object is presented he attends one to the exclusion of the other, or he may attend the two objects alternately.

By 40 weeks three or more objects can be simultaneously "kept in mind"; the infant can attend a large and a small object at the same time, with special interest in the small. The scope of his attention has widened to include the whole table top, instead of just the circumscribed area immediately before him.

By the end of the first year he can refer to the examiner or to his mother without losing track of his play objects; he traces objects from their source and to their destination (platform, floor). He exploits the under-surface of the table, the inside of the cup, the crib rails, the shade over the mirror behind him. He seems aware of the whole room and everything in it, and he can *choose* what he will attend to. His attentions may now be described as external, inclusive, selective, and versatile. Throughout the whole latter half of the first year his attentions are notably consistent, durable, and related to immediate objects and events; but the scope of attention is continually expanding in space.

With the acquisition of walking, attention shifts become more rapid and diversified. Attention as well as posture is no longer sedentary. It shifts from one interest to another; it is deflected by almost every intervening object or occurrence. In fact, diversion seems to be the most outstanding quality of the attention of the 18-month-old child. He appears to be led here and there by the immediacy of his shifting interests and by his impacts against the world about him. His whole psycho-motor complex is in a transitional but constructive stage of unstable equilibrium.

The ability to maintain an objective while surmounting an intervening obstacle to that objective, begins to appear shortly after 18 months. This projection of attention into the immediate future

is the first real conquest of time-space barriers. Further conquests are made possible by the elaboration of his language powers.

§ 2. THE SYMPTOMATOLOGY OF NEURO-MOTOR FUNCTIONS

The development of the various functional areas and of the various functions has been traced in broad outline, because an understanding of the normal developmental processes is essential to the diagnosis of sensory and motor deviations in infants and young children. One must understand how a function develops, the various stages it goes through, and how it is correlated with other functions. Normal development, as it has been described, is dependent upon an intact organism. Disease, defects, or damage that impair the integrity of the organism deflect the normal currents of development.

It is not our purpose to describe all the diseases, defects, and damages that may befall an infant, but to show how the developmental examination establishes integrity or exposes damages and faults. Abnormal behavior patterns thus become understandable in terms of functional developmental stage, in terms of integration with other functions and in terms of equipment with which to perform that function.

Normal equipment includes normal developmental potentials, normal receptors and normal effectors. Loss or impairment of vision, hearing, touch or proprioception, the most important receptors, interferes seriously with the acquisition and integration of normal experience and with the development of appropriate responsive behavior. An infant cannot develop normal responses to things he cannot see or hear or feel. Loss or impairment of movement and, later, of speech, the two most important effectors, precludes normal responsive behavior and may thus interfere with the acquisition of normal experience.

This is not to say that responsive and appropriate behavior is never developed by handicapped individuals; it is. But it is not developed with normal ease, nor through normal channels and it is not fully normal behavior in its organization.

The blind child learns and develops through his remaining receptors; through hearing, touch, and proprioception. To grasp an object he must hear or feel its location or he must grope for it. Unless he knows in advance of grasp exactly what the object is, his

prehensory approach may be inappropriate to the size, shape or weight of the object. The deaf child learns and develops through vision, touch and proprioception. He may eventually establish "normal" communication with other individuals by lip reading and speech. But his speech is never quite normal and lip reading is never as efficient as hearing. The crippled child may learn to walk, but he uses crutches or braces or accessory muscles; and he is lame. As for an infant who was blind, deaf, completely insensate and paralyzed, if he could undergo developmental organization, what direction would development take? How would he express it?

The effects of visual and auditory handicaps on development will be discussed in the chapters on Blindness and Deafness (Chapters XIII, XIV). The present chapter and the one which follows will deal in the main with motor and associated proprioceptive disabilities.

It is axiomatic that it is easier to exercise a skill than to acquire it. The adult has acquired his motor functions; he exercises his skills. A superimposed motor disability impairs motor functions, but it does not necessarily abolish previously acquired skills. A man may still walk without much difficulty after losing the proper use of several muscle groups normally used in walking.

In infancy, the problem is a little different. This is the period when motor functions are in the process of development, and when functions are being integrated into skills; the infant has to develop a skill before he can use it. Motor disability not only impairs motor function, just as it does in the adult, but it also impairs the infant's ability to develop motor functions. He is under a double handicap: the handicap to function imposed by the disability, and the handicap which the disability imposes on learning the function. The same disability which merely affects the adult's gait may delay the acquisition of walking in a young child for years.

Motor handicaps in infancy greatly increase the difficulty of acquiring a skill; they greatly increase the length of time needed to acquire a skill; they greatly exaggerate the awkwardness displayed in the nascent and assimilative stages of the development of a skill. These facts make motor handicaps readily apparent in infancy, because their effects tend to be magnified. The recognition of motor handicaps is the first step in diagnosis.

Motor disabilities, whether mild or severe, local or general, transient or permanent, express themselves by reduction or disorder of motor performance. Motor retardation, on the other hand, implies a performance normal in quality, abnormal only in terms of age.

Reduction in motor function is present when there is hypotonus, muscular weakness, or flaccid paralysis. These three signs represent essentially gradations in loss of power. Outright frank paralysis is readily recognized. It is the weaknesses and hypotonias that are so often overlooked unless functional ability is strictly evaluated in terms of age and maturity. Even if noticed they are too often dismissed with a shrug: "He is such a fat, heavy baby," or "He's just lazy." They are almost as frequently misunderstood, because too many diagnoses of amentia are made solely on the basis of motor performance: "Your child is retarded." A careful distinction must be made between reduction in function and retardation in function, even when the two appear in combination.

The developmental examination is, in essence, a series of *functional tests*. The infant is fortunately so constituted that although he cannot respond to verbal commands, it is easy enough to elicit motor performance. Positional change induces motor performance, lures and toys induce motor performance, his own spontaneous activity is largely motor performance. We do not ask him to move a part or to squeeze a dynamometer; we "ask" him to resist the forces of gravity. He does it if he can: reflexly at the earlier ages, a little later, voluntarily. We induce him to reach, to lift and to hold, by offering him a plaything.

The signs of loss of power are in general similar, regardless of cause or location. The chief signs are loss of power, overaction of opposing muscles, and diminished reflexes. The examination tests the infant's power to turn the head, to lift the head, to open and close the mouth, to move the eyes, to brace the shoulders, to move the arms in various planes, to grasp objects, to sit erect, to move the legs freely, to assume weight support. We investigate the ability to swallow, to chew, to articulate, to control the sphincters. Finally, we compare the ability of the child with the norms appropriate to his level of maturity. For a tabulation of specific motor signs consult the Diagnostic Syllabus (page 212).

The causes of weakness and hypotonia may be numerous and

diverse. They may be due to general systemic conditions, to local conditions in the muscles themselves, to disturbances in the central neural regulation of muscle tone, to lesions or defects in the motor cranial nerves or in the pathways of the lower motor neurones. It is beyond the scope of this volume to consider the differential diagnosis of reduction of motor power as related to rickets, debility, amyotonia congenita, congenital absence of a muscle, disuse atrophy, anterior poliomyetis, myelodysplasia, Erb's palsy, polyneuritis, etc.

The disorders of motor function are manifestations of release phenomena; release of inhibition or of regulation. Here again, the disorder may be due to a general systemic condition, such as infantile tetany; to a local condition as in the muscular spasm that occurs with fracture and scurvy; to disturbances in the central regulation of muscle tone; to lesions or defects of the nuclei or pathways of the motor cranial nerves; to lesions of the upper motor neurones including the motor cortex.

The motor cortex and its pathways are concerned with volitional movement. Thus it is stated that the signs of damage to the motor cortex are not apparent until the child is old enough to attempt voluntary movements. This is, however, not strictly true. The cortex does not suddenly assume control over movement. The acquisition of control is a developmental process. Every organ is ready and able to function long before its functioning is apparent; every organ functions in some measure before it functions completely.

Marked spasticity, the outstanding sign of damage to the motor cortex, becomes obvious when voluntary movements are attempted; it is, however, often heralded before that time by hypertonicity (and hyperactive reflexes). Mild forms of spasticity may easily pass unrecognized if the clinician is content with performance, regardless of the context and manner of the performance. How a child does a thing is as important as doing it, or not doing it. Actually, hypertonicity in the early months of infancy may present a fictitious picture of motor acceleration: "The baby extends his legs so well in standing," "His grip is so strong," "He tenses his body so vigorously when he is picked up."

Hypertonicity and spasticity cause muscle over-activity. They may also contribute to disco-ordinations of movement by preventing the

proper relaxation of antagonists. They are often present in associa-
tion with hypotonus and weakness. The problems are far from simple.

Hypertonus and spasticity, in the early months, as has been stated,
may simulate precocious motor development. When voluntary con-
trol of movement begins to emerge, however, it becomes more and
more apparent that the element of *relaxation*, so necessary to smooth
muscle performance, is deficient or lacking. If one muscle group
cannot relax, the opposing muscle group cannot do its work ef-
fectively. We begin to see disability in motor performance. An act
cannot be performed with normal ease and control; *effort* becomes
obvious. Whereas the normal infant performs easily, the spastic
infant performs only with effort; or he may not be able to perform
at all, normal movement is so impeded by muscle spasm.

By the same means with which we test for reduction in motor
function, we test for disorder of motor function. Knowing the
normal developmental patterns we are alert to abnormal and exag-
gerated postural, prehensory, locomotor, articulatory, and degluti-
tional patterns, and their hypertonic, spastic elements are recog-
nizable.

Over-active extensor muscles produce exaggerated extensor
positions and interfere with activities requiring use of the flexors.
The infant may be unable to sit, though he stands well with support;
or he may be unable to bring an object to his mouth. Over-active
flexors produce exaggerated flexor positions and interfere with
activities requiring the use of extensors. The infant may have great
difficulty, for example, in releasing his grasp. If both flexors and
extensors are involved, voluntary movement may be up against an
impasse.

Involvement of the muscles of the mouth, tongue, pharynx,
larynx, and diaphragm affect swallowing, chewing, and speech.
Language development may be little affected in the first two years,
though vocal expression and output are usually somewhat reduced.
Jargon, surprisingly enough, is often quite normal. But when true
speech is attempted it may be quite impossible, or it may be pro-
duced only with the great effort, explosiveness, and indistinctness
that characterize spastic speech. Many cases of stuttering undoubt-
edly have a spastic basis; the disability is often relatively mild and
only becomes apparent under emotional stress. Disco-ordinate, spastic

tongue and pharyngeal muscles are the basis of many "feeding problems." Such difficulties are often erroneously attributed to neurotic factors in mother or child. In many if not most instances they have a pathological, neurological basis. In some cases the signs are almost completely limited to these oral patterns; in other cases they are but one aspect of a more extensive neuro-motor impairment. The importance of feeding difficulties as neurological indicators should not be underestimated.

The *disco-ordinations* of movement include tremors, asynergies, ataxias, and the gross involuntary movements associated with athetosis. The basic lesions and defects are largely extra-pyramidal and are located in the basal ganglia. The disco-ordinations are rarely pure; they are often associated with tonal disorders and usually have a spastic element of greater or lesser degree. In the rarer instances of cerebellar affections, nystagmus, cerebellar tremors and ataxias, and hypotonia appear.

Disco-ordinate movement implies mal-directed, mal-timed movement, complicated by accessory, super-added movement. Tremors are exceptional in that direction and timing may be relatively unaffected; the super-added movements are fine, rapid rhythmic and compensatory. Tremors may be constant or appear only on voluntary movement, or only under effort or stress. Ataxic movements are larger, slower, not rhythmic or regular, but they are compensatory. They appear on voluntary movement.

Athetotic movements are usually described as gross, purposeless, slow, tortuous, and writhing. Perhaps distorting is a more descriptive term than writhing; athetosis distorts movements and deranges their normal course. Athetotic movements may appear spontaneously while the child is relatively motionless; they appear on voluntary movement; they may be practically continuous except during sleep. They vary in intensity and scope from the severe, generalized forms to the mild, more localized manifestations, though there is always a tendency for them to spread or overflow. When the patient attempts to move a limb, its movement is at once distorted by gross, involuntary, accessory movements which spread to other parts of the body; in milder cases perhaps just to the face producing grimacing; in more severe cases the overflow may be quite generalized. The head twists, the eyes roll, arms, legs, and trunk are all involved.

When speech is attempted the whole body may contort and laryngeal movements may be so deformed that nothing intelligible is enunciated. With involvement of the diaphragm, respiratory, phonetic and articulatory movements may be so disco-ordinate that not even a whisper can be produced. Gross movements of the diaphragm and abdominal muscles, particularly in the presence of an incompetent cardia, may produce sudden vomiting, almost projectile in character,—another "feeding problem."

The athetotic child may apparently try to wait until the involuntary movements have subsided, only to have them begin again with the next attempt at voluntary movement. More successful is his device, when he can employ it, of controlling the extraneous movements by bracing the moving part. He adducts the arms close to the chest, or he attempts to keep his hands in contact with the table surface. In mild cases he may quite successfully conceal his difficulty until he is induced to reach out into space. Sometimes the only discernible sign is an abnormal posturing of hands and fingers—a frozen section, as it were, of athetotic movement.

The infant may be several months old before the exact nature of the disco-ordination of movements becomes clear. Before that time, however, abnormal postures, disorders of tone, exaggerated and abnormal reflexes, and mal-development of function are apparent and they are indicators of neuro-motor pathology.

Mild tremors and ataxias usually permit performance but disturb its efficiency. The child accommodates and is not seriously handicapped in the development of function, even though the function may be poorly performed. The more exaggerated tremors and ataxias, however, interfere signally with successful performance. And any significant degree of athetosis is always a serious obstacle. Performance is accomplished only with enormous effort. A large percentage of efforts fail entirely. The extraneous movements bring in a flood of confused and disordered proprioceptive impulses which do not serve to simplify matters for the developing child.

Disordered movement is reflected in posture, in locomotion, in ocular and manual adjustments, in swallowing, breathing, articulation and also in modes of attention. Effort exhausts attention, lack of success eventually dampens initiative, extraneous movements and

their accompanying proprioceptive sensations distract attention. Attention is undoubtedly very closely related to the maintenance of postural set and particularly to ocular fixation in the seeing child; even small digressions and dispersions in ocular control tend to scatter and divert attention. Ocular behavior is, in fact, a part of the child's total behavior complex and partakes of most of its attributes. The composed, slow-moving child will show slow, controlled eye movements, steady ocular and attentional fixations; the hyperactive child will show very rapid movements, fleeting fixations, and his attention will be equally mercurial. The child with spastic, labored movements will have difficulty in bringing his eyes to bear on an object and in holding his gaze, difficulty in fixing and holding his attention. The athetotic child who shows extraneous disco-ordinate bodily movements will show some degree of extraneous, disco-ordinate eye movements, and his attention will partake of the same circuitous, irregular motion.

Figure 12 presents a series of diagrams representing the deviations of the patterns of movement that occur under the various conditions of neuro-motor control which have been under discussion.

In this discussion we make no attempt to describe exact disease syndromes or localizing signs. It might almost be stated that in infants and young children the symptomatology of nervous disease tends to be diffuse rather than localized; in fact, the lesions and defects which produce the symptomatology tend to be diffuse. Lesions are not, as a rule, limited to the internal capsule, nor neatly located in the sphenoidal fissure. Few hemiplegias in children are true hemiplegias; usually both sides of the body are involved, one more seriously than the other. Classic neurological syndromes may be approximated, but because the lesion or defect occurs in a developing organ, whether in the germinal, embryonic, circumnatal or postnatal period of life, the pathology tends to be widespread and diffuse, even when the visible damage is not gross. It is perhaps more important to recognize the diffuseness of the lesion than its limitations.

It is this diffuseness that accounts for the injury to intellect and to personality that so often accompanies affections of the nervous system in infancy and childhood. Intelligence, of course, is not

FIG. 12. Diagrammatic representation of a single movement from Position A (point of origin) to Position B (goal) under various conditions of neuro-motor control.

B.

A

Normal

Weakness
Reduction in power and tone. May be unable to hold position.

Paralysis
No movement.

Moderate Spasticity
Over-action, disco-ordinate and excessive tone.

Severe Spasticity
Over-action, disco-ordination and excessive tone. Misses goal completely.

Tremor
Rhythmic; increases as approaches goal. Tone may be normal.

Mild Ataxia
Deviates, over-shoots and compensates. Tone may be normal.

Severe Ataxia
Repeated deviations and compensations. Tone may be normal.

Moderate Athetosis
Variable spastic element. Inability to hold position.

Severe Athetosis
Variable spastic element. Misses goal completely.

localized in any single gyrus or lobe. Intelligence and personality alike are mediated by the entire cerebrum.

We have come to believe that personality, like intelligence, has a structural basis, no matter how much that structure lacks compactness or precise configuration. A hemorrhage or a toxin can injure it, disease can destroy it; or its endowment and therefore its function can be inadequate.

Some of the more characteristic signs of personality defects in infants and young children include irritability, hypersensitivity, hyperexcitability, hyperactivity, disorders of attention, faulty functional integration, perseveration, lack of drive; taken together in various combinations they form the behavior complex to which the term instability has been applied. When an unstable child has to meet the problem of development, behavior disorders result. A mild case may not reveal his inadequacy unless or until his developmental environment makes excessive demands upon him. (It is conceded that perfection in personality endowment is not common, that mild defects and inadequacies are characteristic of the average, normal individual.) Severe cases may develop symptoms under the best of environmental conditions, under the simple stress of living and . growing up.

When instability is associated with such neuro-motor signs as strabismus or a history of persistent, inadequate feeding responses in early infancy, or disturbances in muscle tone, abnormal posturings, etc., we may suspect structural damage to the brain. The question would be merely academic were it not for problems of treatment. Recognition of real, permanent structural damage should do something to dampen the optimism roused by the promise of psychotherapeusis. It may ameliorate, but it cannot eradicate the defect.

The Diagnostic Syllabus which follows is self-explanatory. Under various anatomical and functional headings it lists the abnormal neuro-motor signs most frequently encountered, lists the most fre- quent possible causes and gives the age limit at which each sign takes on pathological significance. The syllabus in itself does not yield a diagnosis. It enables the examiner to assay functions, skills, and behavior patterns in terms of maturity and adequacy, suggesting possible alternative explanations for inadequacies. The clinician must apply the syllabus in terms of the total symptom complex.

§ 3. DIAGNOSTIC SYLLABUS OF ABNORMAL NEURO-MOTOR SIGNS

Sign	Possible Causes	Normal (to Age Specified)
HEAD		
Failure to maintain erect posture ..	Weakness neck extensors; athetosis; retardation	12 wks.
Failure to erect head from prone...	Weakness back extensors; retardation	12 wks.
Persistent tilting................	Visual defect; torticollis	No age
Rolling, banging...............	Emotional factors; retardation	No
Gross, intercurrent involuntary mvts	Athetosis	12 wks.
EYES		
Ptosis.........................	Weakness, paralysis levator palpebrae	No
Strabismus.....................	Weakness, paralysis oculomotor muscles; visual defect	12 wks.
Nystagmus.....................	Visual defect; albinism; cerebellar defect; retardation	No
Failure of fixation, perception.....	Visual defect; retardation	No
Immobility.....................	Ophthalmoplegia	No
Random, uncontrolled movements.	Visual defect; athetosis	No
MOUTH		
Open, drooling.................	Poor tone lips, tongue, jaw, pharynx; retardation	40 wks.
Deficient sucking...............	Poor tone, disco-ordination lips, tongue, jaw, pharynx; retardation	1–2 wks.
Choking on fluids...............	Disco-ordination muscles of swallowing	1–2 wks.
Choking on (semi-) solids.........	Disco-ordination muscles of swallowing; retardation	28 wks.
Failure to chew................	Disco-ordination lips, tongue, jaw; retardation	18 mos.
Air swallowing (excessive)........	Disco-ordination muscles of swallowing; retardation	40 wks.
Jaw clonus.....................	Hyperexcitability jaw muscles	6 wks.
ARMS AND HANDS		
Relaxation shoulder girdle, lifting..	Poor tone, weakness, paralysis shoulder girdle muscles; retardation	8 wks.
Adduction upper arm............	Spastic adductors; weakness deltoid	No
Persistent flexion at elbow........	Spastic flexors	No
Persistent extension at elbow......	Spastic extensors	No
Failure to reach................	Spastic or flaccid paralysis; visual defect; retardation	20 wks.
Maldirected reaching	Disco-ordination antagonistic muscles; spasticity; athetosis; ataxia; visual defect	24 wks.
Gross intercurrent involuntary mvts.	Athetosis	No
Tremors.......................	Emotional factors; basal defect; cerebellar defect	No
Fisted hands...................	Spastic flexors	16 wks.
Excessive strength of grasp........	Spastic flexors; disco-ordination antagonists	No
Inability to retain an object.......	Disco-ordination antagonists	32 wks.
Excessive extension in release.....	Disco-ordination antagonists	18 mos.

DIAGNOSTIC SYLLABUS OF ABNORMAL NEURO-MOTOR SIGNS (*Continued*)

Sign	*Possible Causes*	*Normal (to Age Specified)*
ARMS AND HANDS (*Continued*)		
Poking, tipping instead of grasp....	Disco-ordination antagonists; emotional factors; retardation	No
Difficulty in release............	Spastic flexors; disco-ordination antagonists	15 mos.
Abnormal posturing fingers; mannerisms......................	Spastic contractures; disco-ordination antagonists; athetosis; visual defect; emotional factors; retardation	No
TRUNK		
Tendency to fall backward (sitting)	Spastic extensors back, hip; athetosis; retardation	32–40wks.*
Tendency to rounded back (sitting)	Weakness extensors back; retardation	32 wks.
Failure to sit independently.......	Spasticity; athetosis; poor tone extensors; retardation	40 wks.
Tremor.......................	Cerebellar defect	12 wks.
Gross intercurrent involuntary mvts.	Athetosis	No
LEGS AND FEET		
Persistent extension..............	Spastic extensors	No
Cross-legged extension...........	Spastic extensors and adductors	No
Immobility in flexion............	Flaccid paralysis; scurvy	No
Persistent tonic plantar flexion toes.	Overactive extensors	No
Spontaneous Babinski............	Pyramidal tract defect	No
Withdrawal in standing..........	Weakness extensors; retardation	36 wks.
Failure to assume weight.........	Weakness extensors; retardation	36 wks.
Supported standing on narrow base	Spastic extensors and adductors	36 wks.
Independent standing on wide base	Weak adductors; disco-ordination antagonists; congenital dislocation hip; cerebellar defect; retardation	21 mos.
Inability to kick (standing).......	Disco-ordination antagonists; athetosis; cerebellar defect; retardation	21 mos.
Inability to stand on one foot......	Disco-ordination antagonists; athetosis; cerebellar defect; retardation	36 mos.
POSTURE AND LOCOMOTION		
Persistence of tonic neck reflex.... .	Extra-pyramidal defect; retardation	24 wks.
Supported sitting on narrow base..	Spastic extensors and adductors	No
Progression by arching in supine...	Overactive extensors; emotional factors	16–20 wks.
Crawling, dragging legs after......	Disco-ordination antagonists; spastic or flaccid paralysis	32 wks.
Progression by rolling............	Disco-ordination antagonists; spastic or flaccid paralysis	No
Over-stepping	Disco-ordination antagonists, athetosis	18 mos.
Scissors gait....................	Spastic extensors and adductors	No
Toddling gait...................	Disco-ordination antagonists; retardation	18 mos.
Lurching, unsteady gait..........	Athetosis; cerebellar defect; congenital dislocation hip; hemihypertrophy	No
Rigid, erect gait.................	Disco-ordination antagonists; overactive extensors; retardation	21 mos

* Normal for the period from 32 to 40 weeks.

DIAGNOSTIC SYLLABUS OF ABNORMAL NEURO-MOTOR SIGNS (*Continued*)

Sign	*Possible Causes*	*Normal (to Age Specified)*
"One-sided" gait	Hemiplegia; unilateral visual defect; congenital dislocation hip; hemihypertrophy	No
Propulsive gait	Athetosis; cerebellar defect	No
Walks on toes	Overactive extensors	No
Inability to walk (run)	Flaccid or spastic paralysis; athetosis; retardation	18 mos.
SPHINCTERS		
Urinary dribbling	Lesion sacral plexus or lumbar cord	No
Enuresis	Emotional factors; retardation	24–30 mos
Nocturnal enuresis	Emotional factors; retardation	3–4 years
Fecal incontinence	Lesions sacral plexus or lumbar cord; emotional factors; retardation	15–18 mos
SPEECH		
Indistinct, defective	Disco-ordination lips, tongue, pharynx, larynx, diaphragm; auditory defect; retardation	3 years
Delayed, inhibited	Auditory defect; emotional factors; retardation	24 mos.
Absent, "only noises"	Auditory defect; retardation	12 mos
Spastic	Disco-ordination lips, tongue, pharynx, diaphragm	No
Stuttering	Disco-ordination lips, tongue, pharynx, larynx, diaphragm; emotional factors	No
EXPRESSION		
Lack of expression	Poor tone facial muscles; visual defect; postencephalitis; retardation	8 wks.
Facial weakness	Paresis facial muscles	No
Grimacing, tics	Athetosis; emotional factors; retardation	No
ATTENTION		
Deficient	Fatigue; emotional factors; retardation	4 wks.
Absent to words	Auditory defect; retardation	12 mos.
Absent to objects	Visual defect; retardation	8 wks
Absent to gesture	Visual defect; retardation	36 wks.
Distractible, tangential	Fatigue; emotional factors; retardation	15-18 mos.*
Labored	Spasticity; athetosis; fatigue	No
Circular	Athetosis; emotional factors	No
Periods complete abstraction	Petit mal; emotional factors; fatigue	No
EMOTION		
Inhibited, seclusive	Emotional factors; retardation	No
Excessive crying, resistance, tantrum	Auditory defect; emotional factors; retardation	15-18 mos.*
Irrepressible laughter	Thalamic lesion; emotional factors; retardation	No
Overactivity, excitability	Thalamic lesion; postencephalitis; emotional factors; retardation	No

*Not abnormal for the period from 15 to 18 months.

CHAPTER XII

CEREBRAL INJURY

The methods and concepts of developmental diagnosis are of special importance in the interpretation of cerebral injuries. Most of these injuries occur prior to, during, or soon after birth. All told, they comprise perhaps one-fifth of all cases of amentia, and over one-third of the motor disabilities of crippled children. They also account for a considerable but indeterminable number of children who suffer from personality deviations, dullness, various forms of inadequacy, and subclinical defects and deficits. Because of the inaccessibility of the underlying neuro-pathology, it is frequently impossible to demonstrate causal relationships between cerebral injury and the imperfections of human behavior. With present available methods there is probably more danger of under-estimating than of over-estimating the importance and prevalence of cerebral injury. In this chapter we shall not limit the subject to the frank cerebral palsies; and we shall use the term birth injury sparingly to avoid the implication that the defects were due to preventable obstetrical errors.

§ 1. THE MECHANISM OF INJURY

The term injury as here used is equivalent to those destructive lesions which produce secondary types of mental defect and deviation, namely, traumata, hemorrhage, infections, toxic agents, anoxemia, irradiation. The lesions may occur singly or in combination; they may be super-added to a primary amentia; they occur at varying stages of the life cycle, including the time of uterine implantation and the embryonic, fetal, natal, neonatal, and later postnatal periods. The injuries may be severe and devastating; they may be extremely

mild, diffuse, or more or less circumscribed. Those which are associated with gestation and birth are of special clinical importance.

We are here mainly concerned with the behavioral and developmental end-products of cerebral injury. No attempt will be made to describe specific structural pathology. It will be sufficient to recall the different general forms, varying from gross to subtle which the lesions assume: destruction and laceration of tissue; scar formations with and without adhesions; meningeal and ventricular abnormalities; gliosis with and without vascular occlusion; necrosis; atrophy; hemorrhagic foci; cytologic impairment.

The behavioral gravity of any injury of course depends upon the extent and site of the lesions. The maturity of the organism also is a factor of great importance, as emphasized in the preceding chapter. Although a neurone once destroyed cannot be regenerated, it can sometimes be replaced by the compensating development of an unharmed neuroblast. Neuroblasts are so numerous that they probably serve as a reserve capital which may be drawn upon in certain kinds of bankruptcy. Compensatory increase of Betz cells in a hemiatrophic brain has been definitely demonstrated. It is quite probable that other types of neuroblasts undergo similar increase in healthy individuals. Damaged neurones can undergo partial recovery. The very success of physiotherapy and muscle training suggests the existence of such insurance factors. The effectiveness of these factors doubtless varies with the hereditary vitality and the age of the child.

The mildest form of injury which we have called cytologic impairment is so delicate that it must be conjectured on the basis of clinical manifestations. The impairment may be visualized as a deformation or curtailment of molecular structure which produces bio-electric alterations and which disturbs directly or by remote action (and deflection of action) the integrative and attitudinal functions of the cerebral cortex. In such instances the cerebrum is sufficiently insulted during a sensitive morphogenetic stage to register subtle but significant damage. The outward manifestation is some slight motor deficit or personality deviation. Deficit and deviation alike are more properly ascribed to protoplasmic damage than to hereditary or psychogenic factors.

The very fact that even brief periods of oxygen deprivation may

have pronounced and persisting effects upon nervous system function should give weight to the suggestion that minimal cerebral injuries constitute a valid clinical category. By the same token asphyxia at birth is a symptom of far-reaching clinical consequences. The breathing behavior of the newborn baby is probably the most sensitive indicator of his well-being.

Although anoxemia may sometimes be present without apnea, apnea is the important clinical sign of anoxemia. The most immediate and vital effect is upon the brain where isolated groups of cells speedily die because of oxygen want. Cerebral anoxia, produced by obstetrical analgesics, oxytocics, and anesthetics, may cause intracranial hemorrhages *in utero*. When these drugs are administered in excessive dosage, or when the administrations are improperly timed, they produce apnea with its chain of consequences.

The seriousness of these consequences is subject to considerable individual variation. A newborn ament is likely to show cyanosis of severe grade on small provocation. Such cyanosis might be regarded as symptomatic rather than etiological. On the other hand an infant of superior endowment may escape some of the permanent effects which an inferior child would suffer. The well-endowed nervous system is undoubtedly better protected against the adversities of trauma because it has a wider margin of safety in the form of neuroblastic resources and biochemical responsiveness.

The neonatal period is of necessity a critical period for all who survive the catastrophe of birth. The excessive mortality of this period is itself convincing proof that it is an extremely difficult transition for the organism to achieve. The transition does not eliminate on an all-or-none basis. If all who were biologically completely fit survived and all others perished many of the developmental problems to which this volume is addressed would not exist. Nature solves the issue by compromises and penalties. The hazards of birth are virtually universal. Some degree of threat, some insult, and some slight and at least transient cerebral injury is the common lot of humanity.

It is not necessary to subscribe to the Freudian doctrine of psychogenic birth trauma to acknowledge the developmental importance of the disturbances and vicissitudes of the neonatal period. The

infant may not be homesick for the Edenic security of the uterus, but he assuredly has some difficult adjustments to make to his novel environment. A mere cataloguing of these fundamental physiological adjustments will reveal the burden which is placed upon his cerebrospinal and autonomic nervous systems. Pulmonary inflation, heightening of muscle tonus, sustained rhythmic breathing, elevation of blood pressure, reduction of heart rate, destruction of excess cells of plethoric blood; reorganization of cellular constituents of the blood; increase of systolic and diastolic blood pressure and reduction of heart rate, progressive reduction in the bleeding and coagulation time, the mobilization of antibodies in the blood plasma; a tenfold increase in gastric capacity in as many days; the establishment of gastric, biliary and intestinal secretions; massive bacterial invasion of the alimentary tract; sudden increase of demands on kidney excretion; equilibration of the fluid matrix of the body with respect to water and salt contents, blood sugar, proteins, fat and calcium; the regulation of body temperature and adequate oxygen supply; the acquisition of patterns and rhythms of feeding, activity, and sleep—these are the converging and concurrent demands made upon the organism as soon as it is born. Never again will the body have to acquire so much wisdom in so short a time. And in this sense it is a wise baby who achieves these adjustments in the first fortnight after birth. For many infants the task is so great that they are either still-born or die within two or three days, because of some defect in homeostasis; that is to say, the co-ordinated physiological mechanism by which the organ systems co-operate to produce the steady internal environment on which life, growth and behavior depend. The nervous system, both autonomic and cerebrospinal, participates in the regulation of these processes and also reflects disturbances of the internal states. Even in the adult the nervous system suffers when the limiting concentrations of hydrogen, oxygen, glucose, water, sodium and calcium are transgressed. Excessive water engenders headache, nausea, dizziness, asthenia, inco-ordination. Excessive sodium produces reflex irritability, weakness, paresis. In Claude Bernard's famous dictum, "It is the fixity of the *milieu interieur* which is the condition of free and independent life."

The neonate is engaged in organizing this elaborate complex of adjustments. The goal is a steady internal environment, a stable

interior milieu. The infant is born but he must struggle for his very existence. In this struggle he appears unsteady, unstable. He fluctuates from day to day; he swings through wide oscillations in temperature control, and in biochemical controls such as the percentage of blood glucose; he is subject to tremors, to reversals of peristalsis, to exaggerated responses. Normally he weathers all of these storms and settles down to relative stability in about two weeks.

If, however, he has suffered even slight injury, due to intra-uterine, natal or postnatal mishaps, he is likely to show symptoms of unsteadiness or instability for months or even years. These symptoms are not necessarily frankly motor. He is likely to manifest convulsive and other neurologic signs in periods of stress or during febrile disease, the functional efficiency of his total homeostatic equipment having been somewhat impaired. This equipment also embraces his latent maturational mechanisms, which are fundamentally physiological. He may therefore display mild deviations not only in behavior dynamics but also in the development of behavior. Even if in later childhood he achieves clinical recovery, he can be classified in the group of minimal cerebral injuries.

The etiology of minimal injury is obscure but it is presumptive in the absence of decisive hereditary or environmental determinations. If the birth and neonatal history is adverse, slight clinical signs should be given much weight. If the history is apparently normal but the signs are strongly suggestive, a diagnosis of cerebral injury nevertheless may be considered. This does not require us to make a catch-all of the category of cerebral injury, but it obliges us to give serious attention to all behavior signs which show deviations from the normal course of development and reflect marked difficulty in making the neonatal life adjustments.

§ 2. The Sites of Injury

The term injury implies physical damage to physical structure. The gradient of brain injury extends from massive destruction to infinitesimal blemish. The sites of injury are as numerous as the brain is complex, both in its gross and microscopic anatomy. Many injuries are beyond demonstration by present histologic methods. As already suggested the most delicate damages disfigure the molecular structure of the cells and the integrity of the lines of functional

communication between cells. The specific sites of such damage cannot be ascertained. Electrometric methods have been successfully used to plot the position of a hidden cerebral tumor; but they are not as yet sufficiently subtle to locate minimal injuries to the brain substance. It is probable that all insults and injuries to the cerebrum have total as well as specifically localized effects. Even when the site of a gross lesion is inferred from clinical signs, it is easy to overlook correlated effects on regions of the brain which are histologically intact. Behavior remains the most accurate indicator of structural status. Accordingly, in the diagnostic syllabus of neuromotor deviations, we have emphasized the clinical importance of the functional approach.

In spite of all these limitations and strictures it is often helpful to envisage the sites of cerebral injury in an effort to correlate observed symptoms with generally accepted facts of neuro-anatomy. As an aid to such correlation we present a table (p. 221-222) which may be consulted as a frame of reference. The table consists of two parallel columns, the first of which lists the various structures of the central nervous system; the second specifies the normal functions which are ascribed to these structures. The table should be taken schematically rather than literally. It is not assumed, of course, that any one level or structure functions independently without participation by other parts of the nervous system.

§ 3. DEVASTATING INJURY

Extremely profound cases of idiocy are due as often to a devastation by injury as to a primary deficiency of developmental potentiality. For this reason profound deficiency is frequently associated with a relatively normal physique and comeliness of countenance. The contrast in physique and mentality adds to the pathos of the picture, and often increases the resistance of the parents to an adverse prognosis. They cling to hope because the child smiles in a winning manner. They think it must be impossible for a child so attractive to be permanently defective.

On the other hand, when the diagnosis is accepted, the assurance that the amentia was caused by injury to the brain rather than by inheritance affords some comfort. Ordinarily there is no contraindication to further offspring.

SCHEMATIC TABLE OF STRUCTURE-FUNCTION CORRELATIONS

Structure	Ascribed Normal Function
Autonomic System	
Cranio-sacral...................	Appetitive and organic sensation
Thoraco-lumbar	Preparatory emotion
Spinal Cord	
Spino-medullary tracts...........	Proprioceptive impulses
Lateral spino-cerebellar..........	Proprioceptive impulses
Interspinal.....................	Proprioceptive impulses
Spino-thalamic.................	Pain and temperature
Cerebro-spinal.................	Efferent conduction
Rubro-spinal	
Medulla	
Nuclei, gracilis	First proprioceptive relay
Nuclei, cuneatus	Sustained segmental reflexes
Medial lemniscus................	Conduction to thalamus
Inferior olives......	Relay for nuclei gracilis and cuneatus
Nuclei, cranial nerves...........	Vegetative regulation
Cerebellum	
Afferent tracts..............	Conduct proprioceptive impulses
(1) dorsal; (2) nuclei gracilis and cuneatus; (3) inf. olives; (4) lateral; (5) vestibular	
Efferent tracts.......	Conduct impulses of co-ordination, modification, and reinforcement
Superior peduncles	
Cerebellar-rubral	
Cerebellar-thalamic	
Cortex	Energizes
	Checks and modulates
	Dual transformer (excitation and inhibition)
Midbrain	
Inferior colliculi................	Subcortical center, hearing
Superior colliculi................	Visual-motor responses
Nuclei: nerves III, IV...........	Oculo-motor impulses
Tegmentum-substantia nigra........	Regulation of postural tonus
Red nucleus....................	Maintains lasting posture background on which cerebellar checks imposed
Extra-pyramidal tract	
Thalamus: Afferent	
(1) Medial geniculate bodies........	Afferent; hearing
(2) Lateral geniculate bodies......	Afferent; vision
(3) Pulvinar.....................	Afferent; vision
(4) Lateral nuclei	Cutaneous sensibility, trunk, limbs
(5) Ventral medial nuclei..........	Cutaneous sensibility, face
(6) Ventral lateral nuclei..........	Proprioceptive impulses
(7) Arcuate nuclei (cbl-th. tr.)......	Proprioceptive and intra-neural excitation
Spino-thalamic tract	Pain
	Affective toning; pleasant and unpleasant
Thalamo-cortical radiations	Affective quale through reverberation
Thalamus: Efferent	
Sub-thalamus....................	Mediates extra-pyramidal impulses
Central nucleus..................	Postural reactions
Nuclei of Luys..................	Postural reactions
Tuber cinereum..................	Visceral reactions and olfaction
Mamillary nucleus...............	Feeding reactions; metabolic regulation

STRUCTURE	ASCRIBED NORMAL FUNCTION
Olfactory Lobe......................	Impulses to mamillary nucleus
Corpus Striatum	
Internal capsule	
Thalamo-cortical radiation.......	Motor valves for purposive and postural responses
Pyramidal tracts	
Lentiform nucleus...............	Reciprocal, associated stereotyped reactions
Globus pallidus	
Putamen......................	Food seeking and rejection
Caudate nucleus (anterior).......	Chewing, swallowing, nursing
	Laughing, crying
Cerebrum	
I. Supra-granular cortex plexiform.	Diffuses and summates impulses which come from middle layer
Receptive zone—small cells not part of white bands	
II. Middle granular (pyramidal)...	Exteroceptor and interoceptor
Incoming fibres—small, medium, large	
Pyramidal cells	
III. Stellate layer	
IV. Infra-granular...............	Discharges impulses
Emissive zone	
V. Polymorphic: (a) Motor area	
(b) Receptive areas:	
Proprioceptive and cutaneous, postcentral gyrus...	Receiving station
Parietal...............	Combination, elaboration, interpretation
Superior parietal gyrus...	Cutaneous sensibility
Postcentral gyrus	Muscle sensibility
Visual	
Auditory	
(c) Association areas........	Collect, distribute, integrate, elaborate, irradiate, converge
Frontal................	Phasic control of voluntary movements
Speech centers..........	Organization of verbal engrams
(Island of Reil)	

The paradoxical association of fragmentary normality and extensive defect from injury is well illustrated in Case 1. An informal characterization of this case will best serve to delineate its developmental features and the problems of management involved.

CASE 1, at the age of *3 years*, is brought to the Clinic in a baby carriage and carried to the reception room. Our first glimpse shows her to be a child of attractive countenance. Propped up she is able to sit in a high chair. She sits bent forward. She brings her hands close to the face and activates her fingers as though to look at them, sputtering the while. Occasionally she smiles but the smile has no reference to any of the persons nearby. She seems quite blind to them and heedless of sounds. She turns

her head from right to left but this is an automatic movement without adaptation. For short periods she sits quietly and then rocks back and forth with a weaving motion in her chair. ·

The examiner speaks to her in a natural voice and then with increasing loudness; but there is no evidence of attention. The examiner now taps a cube on the tray of the high chair. The child responds with a movement of quiescence and then continues her spontaneous automatic activity. A cube is touched to the palm of her hand; the hand withdraws. She neither grasps an object nor retains it even when it is pressed into the palm. She blinks when a bell is rung and turns her head responsively. The examiner brings a white enamel cup close to her eyes. The child resumes her rhythmic self-activity and pays no regard to the cup. A formboard is brought before her eyes and moved back and forth. There is not even momentary attention to it. Briefly her hand activity ceases and she seems for a moment to be staring. Then she brings up her hands to her eyes, again lowers her head and resumes her sputtering and fingering. The room is darkened. A light is snapped on and off repeatedly. There may be a vague awareness of change, but she does not look at the light.

Placed in the supine position she turns her head sharply to the right inducing a momentary tonic neck reflex response. She turns her head to the left and back to the right repeatedly, with shifting symmetric and asymmetric attitudes. Her hands engage in mutual fingering near the midline. Her leg activity is unintegrated with other reactions. There are no marked physiological anomalies other than the persistence of the t-n-r. Her reflexes are normal except for a moderately sustained plantar flexion of the toes. There is no spasticity; no flaccidity. When she is picked up, handled and held at the shoulder her muscular tonicity seems quite normal.   ·

This description is brief but it covers almost the entire repertoire of this child's behavior. We are dealing with a cerebral damage of vast proportions, associated with extremely premature birth (birth weight 2 lbs., approximate fetal age, 26 weeks). Delivery was normal and the infant cried immediately after birth. There is a history of frequent minor convulsions, but without massive motor manifestations. Indeed, the relative normality of the motor tonicity and physiological co-ordination emphasizes the severity of the general impairment. The blindness and deafness are presumably due to lesions of the cortical sensory areas and not to receptor defect.

The subcortical structures underwent a certain degree of matura-

tion and were sufficiently spared to produce behavior suggestive of the 12 to 16 weeks zone of maturity. The tokens of behavior were partial and unintegrated; but they kept the behavior picture from appearing entirely random and formless. On occasion, while she lay in the crib, she raised her head momentarily, hinting an urge to sit up. She scratched the blotter on which she lay,—a precursor (normally) of active grasp. She engaged her hands at the midline, a requisite for prehensory closing in. Episodically her apparently aimless self-activity was interrupted with a pattern which suggested hand regard: her eyes stopped their rolling and nystagmic oscillation; her head ceased its weaving; her eyes converged for a moment upon her hands which at the same moment she held transfixed as though for inspection. Although we could detect no glimmer of visual perception in that fleeting moment, the attitude was the basic motor component of a perceptual pattern which by chance had been spared in the initial hemorrhagic devastation.

In its entirety all this behavior was incomparable with that of a normal 12 weeks old infant whose innumerable patterns and initiatives are bound together and correlated within a unitary reaction system. Each day, each hour, the normally growing 12 weeks old infant is organizing and integrating his behavior equipment. He both learns and grows. This girl scarcely learns at all. There is a faint smiling response to her mother's touch, an almost infinitesimal result of three years of experience. There is no likelihood that she will learn more; nor that she will elaborate the tithe of capacities which remain. More probably her behavior will undergo relative deterioration; for when an injury annuls the potentialities of growth, there is no matrix for the formation of interests and for the progressive organization of patterns of behavior. That is the far reaching result of drastic devastation.

CASE 2 was born prematurely weighing 2520 grams (5½ lbs.) Her birth was precipitate and occurred one hour after the mother suffered a fall. The infant had frequent attacks of vomiting, cyanosis, and tonic spasms of the body coincident with feeding, throughout the neonatal period. Respirations were irregular.

At the age of *12 weeks*, the child was blind and showed marked spasticity of all the extremities. The tonic neck reflex position was assumed with exaggerated intensity. The eyes roamed and although ocular move-

ments were usually co-ordinate, there was no fixation or following, no blink on visual threat, and only occasional narrowing of the eye slits under the stimulus of a bright flashlight. Responses to auditory stimuli on the other hand were fairly well defined. There was prompt blink to a hand clap and cessation of activity on bell ringing. Objects placed in the hand were held with exaggerated reflexive grasp without manipulation or exploitation. No social responses were obtained.

She presented a picture of diffuse cerebral injury with generalized spasticity due to involvement of the motor cortex, and almost total blindness due to involvement of the visual cortex.

At *36 weeks* she showed some evidences of vision, following a light fairly competently, the ring through a small arc, and apparently regarding a toy in hand briefly. Development was not at a standstill and her maturity level had risen unevenly to approximately 12 weeks. Social responses remained deficient. At 40 weeks convulsions supervened; behavior regressed slightly and has remained practically unchanged since that date. At *2 years* of age her nutritional status was good and she gave little trouble to her devoted parents. She was able to eat semi-solid food and remained quiet and happy in her crib all day, vocalizing in a monotonous sing-song, and mouthing her left hand. When handled or talked to she smiled faintly. At *3 years* the story and the picture are virtually unchanged; there has been no developmental progress.

As in Case 1, three years of experience have had almost no effect upon the patterning of behavior. Case 1 has a relatively intact motor system; she sits, rocks and sputters through her fingers. Case 2 is spastic and lies rigidly, mouthing her hand. The adventitiousness of trauma produces a variety of behavior pictures, but in both these children the developmental potentialities have been laid waste. (See also Chapter vii).

CASE 3. In the two foregoing cases the devastational injury was so inclusive that it affected sensory cortical areas. Equally profound degrees of idiocy may be produced by devastational injury which leaves the sensory areas more or less intact. In Case 3, labor was difficult and very prolonged. Vomiting, "nervousness," and convulsive seizures began on the tenth day and continued intermittently for three months, recurring with some regularity at 8 months. She showed hyperactive reflexes, ankle clonus, and a mixture of spasticity and athetosis,—a clear case of mixed cerebral palsy. At the age of *1 year* this girl gave distinct evidence of her ability to hear. She blinked when the bell was rung near her ear, and her

restless activity abated slightly while she listened. She also quieted for a period when the ring was dangled before her face, even following it for a brief distance. But she did not inspect the environment in any adaptive manner. Her active touch was equally deficient. When the handle of the rattle was touched to her hand, invariably the hand withdrew. She held the rattle precariously, the fingers opening and closing in rapid alternation. Her general postural behavior was equally non-adaptive. Her head station was extremely unsteady even when she was held at the shoulder. She did not tolerate the sitting position but reacted by rigid leg extension and head retraction. She tolerated the supine position but tended to roll to the prone position which she preferred. Whether prone or supine she was in constant activity except for quiescent interludes which occurred more or less regularly. The patterns of activity were so unintegrated that various members seemed to be reacting somewhat independently: rolling of the hips and kicking of the legs had no relation to postural adjustment. Even the tonic neck reflex attitudes were poorly defined and often assumed reversals.

Although the cortical sensory areas were spared, this has had and will have but slight effect upon her developmental career. The value of sensory experience, whether visual, auditory, or tactile-motor, depends upon the integrity of the associational areas and of motor effectors.

§ 4. Selective Injury

As already noted, there is an element of selectivity even in devastational injury. We use the term *selective* to designate those cases in which there is considerable survival of behavior capacities, offset, however, by serious defects and deficiencies. There is an extremely wide range of variation with respect to the distribution of intact capacities and defined disabilities. Neurological studies have shown that the lesions may be neatly circumscribed or diffuse. Selective damage tends to produce variegated behavior pictures. The selective cerebral injury is most perfectly and often most distressingly exemplified in basal ganglion lesions. These lesions are gravely incapacitating and yet they may leave the cortical mechanisms relatively unharmed. This clinical type is of special importance because it may simulate amentia so strongly that the patient is denied physiotherapeutic and educational measures to which he is entitled. It is especially important that these cases be recognized in infancy to avoid misunderstanding and mismanagement.

CASE 4 will be presented in narrative form to suggest concretely the nature of the problems of diagnosis and of treatment as they arise and take on definition.

This boy was born prematurely by easy version and extraction. His birth weight was 1690 grams (fetal age 31 weeks). He appeared fairly vigorous but had frequent cyanotic attacks during the first day. He did fairly well for the first two weeks but then became jaundiced, showed opisthotonus and head retraction. The spinal fluid was xanthrochromic. Vomiting and diarrhea were severe and his life was despaired of. After three weeks, however, he began to improve. Opisthotonus and head retraction disappeared about the 40th day, jaundice on the 48th day; weight gain began on the 56th day. At the age of 28 weeks (corrected age about 20 weeks) his weight was 12 lbs. 13 oz. and he was well nourished but the extremities were stiff; abnormal movements of the arms were noted.

The first developmental examination was made at the age of 40 weeks (corrected age about 32 weeks). A total of nine developmental observations were made up to the age of 9 years. A brief recapitulation of the findings of these examinations will best serve to expose the selectivity of the injury, the diagnostic difficulties and the selective effects of the injury on behavior development and educational progress.

32 weeks. The child presented a picture of extreme motor disability. Arms, trunk and legs were spastic; the arms were in almost constant gross athetotic activity. He was unable to sit up without support; voluntary movements of the arms and hands were performed only with the utmost difficulty and with fantastic distortions. In spite of the severity of his neurological symptoms his behavior was remarkable for its vigor and force. During the entire examination his drive was directed with marked intensity toward the test material. Despite the seriousness of his motor handicap he succeeded in approaching the cube and prehending it with a palmar grasp. He regarded the pellet for prolonged periods with recurrent intensity. Personality characteristics were vivid. He displayed eagerness and determination and showed undoubted emotional satisfaction in regarding his own hands, in manipulation of the toys which were put into his hand and in his attempts to exploit them. This satisfaction in achievement was somewhat dramatically displayed in the

rattle situation. He seemed to be trying to bring the rattle to his mouth. The harder he tried, the more rigidly extended his arm became. All at once flexion broke through so suddenly and with such intensity that he struck himself a smart blow in the face, hard enough to produce a real emotional upset in an ordinary child: this boy was delighted. He was stimulated by the novelty of the examination situation and responded eagerly and without fatigue to the whole experience. He vocalized abundantly, squealing, cooing, crowing and laughing.

Making every allowance for his motor disabilities, his behavior approximated the 24 weeks developmental level. This in itself constituted a considerable degree of retardation. But his extraordinary drive, his favorable personality characteristics, and his perseverance strongly suggested the possibility of normal mental development. We recommended more social and experiential stimulation. Because of his early difficulties and his motor disabilities it had been too freely assumed that this child should not have normal experience. He was treated as a bed-ridden child. He responded so eagerly to the test table situations that a program which would give him similar opportunities at home was recommended.

52 weeks. Re-examination at the age of 1 year showed only a slight degree of progress. Descriptively his developmental level had risen to about 30 weeks. He exhibited the same persistence, vigor and drive and the same promising personality traits. We were particularly disappointed that he had not made more gains in the field of language and comprehension.

18 months. At this age Case 4 propelled himself about on the floor by lying on his back and pushing with his heels. He still could not sit without support. Although neither the spasticity nor the athetosis had in any way abated, his prehensory approach was somewhat more direct and grasp was frequently successful. He actually prehended the pellet, and he poked at the clapper of the bell. He managed to combine two objects in exploitive play and he could vocalize "dada." His general level was approximately 40 weeks, and the retardation was apparently greater than the first examination had indicated. Or was the greater retardation merely an expression of the enormous difficulty in learning and in performance imposed upon him by his handicaps? During the next year progress seemed hopelessly slow,

but because progress did continue, because he continued to strive so valiantly and because his original showing had been so good, we continued to hope that this boy would find a competent effector that he could make use of in solving his developmental problems.

At *3 years* he had begun to find the answer in language. With great difficulty he had begun to enunciate words and even to use short sentences. He named seven pictures, could give his own name and answer a few simple questions. Nor were his comprehension and insight deficient. He adjusted to rotation of the formboard and succeeded in imitating a crude circular scrawl in spite of his great difficulty in handling the crayon. His developmental level was fully 24 months with several successes at the 30 months level. Persistence, effort and drive were so impressive that they definitely indicated still greater latent capacities.

By *4 years* there was no longer any doubt that the higher centers had been spared. He had won his way through his handicap and gave the best performance of his career. Speech, though spastic and produced only by great effort, was readily understandable. He recited several nursery rhymes and earned a developmental rating of only a little less than 4 years.

5 years–9 years. The steady progress has continued and the basic intelligence of this boy is certainly very close to average expectations. He can now maintain the sitting position in an armchair and he is able to get about in a specially devised wheeled contrivance that he propels with his feet. He has had extensive muscle training to achieve this degree of control; he will probably never walk. His craving for school experience and his capacity for education has been met, first by visiting teachers in the home and later by an hour a day in public school. He is learning to read with notable success and undoubtedly will be able to use a typewriter. He amuses himself very well with tinker toys and erector sets as do normal boys of his age and he enjoys the children of the neighborhood.

Comment. The neonatal history of this child was more disturbed and more abnormal than that of many cases of devastating injury. The end-results, however, show that much damage was spared. The child has realized his endowment in spite of extreme motor incapacity. His extraordinary drive to do what is almost beyond his motor powers and to perfect what he is doing poorly is attributed

to the potentially normal quality of his native constitution. His driving energy manifested itself even when he was a very young infant. This energy probably has its sources in behavior propensities which are determined by neural structures unimpaired by the basal brain injury. He does not retain the complete neuro-motor equipment to satisfy all these propensities, but he retains the insight to perceive the normal goal of his neuro-motor striving and to notice his shortcomings. He sees the difference between himself and other children, his handicap has been explained to him, and he knows that everything is being done to help him. And he is helping himself; he accepts his disabilities, not passively but actively. His difficulties increase his striving. This is the normal biological response to maladjustment, the one which probably facilitates compensatory development. He continues to surprise us, therefore, with progressive powers.

He showed some of this promise on his first developmental examination. Only a guess can be hazarded to explain why the promise seemed to decline during the second year. It is to be remembered that examination performance and indeed development itself during the first two years is tremendously dependent on motor function. It is our interpretation that he had sufficient motor control to· take the first steps in development. Development was then almost blocked until the time when language and comprehension assume the lead; through this channel normal experiential intake and normal outlets of achievement could flow and pervade his total reaction system. The motor handicap became less important; he could grow and develop and take his place in the family and neighborhood circle in spite of his motor handicap. He has, in a sense, surmounted it.

It is probably wise to place a favorable construction on all evidences of adaptive drive and perseverance. It is a good prognostic sign when a 2-year-old athetotic boy, barely able to sit in a high chair, insists on struggling for ten minutes in order to complete the task of putting the ten cubes into the cup. Six does not satisfy him, he must do it all and do it all himself.

CASE 5* is presented briefly by way of contrast. It is another case

* For a fuller account see *Biographies of Child Development: The Mental Growth Careers of Eighty-four Infants and Children. A Ten-year study from The Clinic of Child Development* at Yale University. Part One by Arnold Gesell. Part Two by Catherine S. Amatruda, Burton M. Castner, Helen Thompson. (New York: Paul B.

of cerebral palsy. In both children the lesion was largely restricted to the basal ganglia and both developed athetosis. Both exhibited superior personality traits and extraordinary drive in spite of severe motor disabilities. Neither was able to stand, to walk, and yet their developmental careers have been significantly different.

At *9 years* Case 5 had never acquired any useful voluntary control of any muscles; he could not hold up his head, sit up, or locomote by any method. He could not fixate his fingers, his eyes, or even his head. He could not communicate except by very poorly differentiated phonations and a crude ambiguous yes-and-no head gesture. Even his facial expression was under poor control. His apparent comprehension of language, however, and his understanding of what was going on about him were at a relatively high level. But in many ways he was inaccessible to the household and to the friends who were attracted by the normal quality and integration of his personality. This personal-social chasm was not bridged by years of muscle training because muscle training failed to bestow any useful degree of motor control. Years of experience and even instruction in reading did not open new vistas for him because he was thwarted at every turn by his pervasive motor disability. Even though the cortical areas had been largely spared by the cerebral injury they were ineffectual because of his inability to muster control effectors.

Case 4 had an overwhelming advantage, even though by inheritance Case 5 had a superior endowment. The advantage consisted in his greater kinesthetic motor control over spoken words, and his greater visual-motor command over printed words; and one might add, his greater physiognomical and postural command over gestures. Case 5 never really mastered even a simple distinct differentiation between a *yes* and a *no* turn of the head. His intellectual life was impoverished because he lacked the psycho-motor verbal engrams

Hoeber, Inc. (Medical Book Dept. of Harper & Bros.) 1939. pp. xvii + 312) and *Correlations of Behavior and Neuropathology in a Case of Cerebral Palsy from Birth Injury* by Gesell, A., and Zimmerman, H. M. American Journal of Psychiatry, 1937, November, 94, 3, 505-535.

Case 5 came to necropsy at the age of 14 years. The lesions in the basal ganglia were typical of the macroscopic picture of *status marmoratus*. Dense glial scars were found in certain parts of the thalamus. They were more conspicuous in the pulvinar and in the ventro-median thalamic nuclei. Cortical cyto-architecture of frontal, temporal and parietal areas was altered as a result of destruction or lack of development of ganglion cells.

to serve as repositories and carriers for notions and ideas. Case 4's ability to gesture, to talk understandably, to recite a score of nursery rhymes at the age of 4, and his ability to read at the age of 8, gave him the proprioceptive implementation for intellectual activity. Case 5 lacked this very implementation; he therefore suffered a kind of intellectual reduction. But even this reduction never brought him into the clinical category of feeblemindedness. In spite of his intellectual poverty, he retained normal modes of thought and a certain perspicacity which clinically were inconsistent with either amentia or dementia.

These two cases illustrate that there is no simple one to one relationship between motor capacity and mental development. Profound amentia may be associated with almost intact motor ability. Profound palsy may be associated with high intelligence. Cerebral injuries, particularly those of the basal type, work selectively.

CASE 6 was seen at annual intervals from 3 to 6 years of age. On her first examination, when she was 3 years old, she presented a definite picture of bilateral spasticity, the right side more seriously involved than the left. She used her left hand with moderate facility and could point, manipulate objects and handle a crayon well enough to carry out the examination requirements if motor ability were all that were necessary. Articulation was not affected.

Birth was instrumental and the child's condition during the neonatal period was poor. She was given several blood transfusions and had to be fed by medicine dropper. Several convulsions occurred during this critical time.

At 3 years of age she was able to sit when tied in a chair; she could walk leaning back against her mother for balance and she progressed independently by rolling on the floor. Her vocabulary was limited to 3 or 4 words and she relied upon a shake of the head for a yes and no response. She filled the cup with cubes, pushed 2 cubes in imitation of the train and differentiated the stroke and circular scribble. She fed herself, played imitatively with a doll and helped her mother in simple household tasks. The developmental examination showed an uneven retardation to the 18 to 21 months level. D.Q. about 50.

Physiotherapy was faithfully continued and at 5 years a Stoeffel's operation was performed with successful results; she mastered independent walking very promptly.

Developmental examination at the age of 6 years showed uneven slow

progress but no real improvement. She walks but is unable to attain the standing position independently; she seats herself in a small chair but needs assistance to get up. She is even able to go upstairs holding the bannister. Her motor abilities are rated at about the 18 months level; her abilities in the adaptive, language and personal-social fields are slightly below the 30 months level. Attention is poorly sustained but is readily and repeatedly recalled. She is an amiable and docile child, defective and handicapped. Her D.Q. is about 45.

The injury in this case inflicted obvious damage on the motor areas but the associational areas were not spared. She has suffered an irregular, diffuse retardation in spite of the fact that her motor equipment for speech is relatively intact and her motor equipment for locomotion, prehension and exploitation while impaired is adequate for successful performance. This child has really competent effectors but the damage to the higher centers has prevented her from realizing any great benefit from this advantage. She is a much less competent child than Case 4 who has a much more serious motor handicap. With normal speech mechanisms she can only join 2 words ("go bye," "call daddy") and can only identify 8 pictures at 6 years of age, whereas Case 4 who had to labor mightily to produce each syllable was reciting nursery rhymes with enjoyment at only 4 years.

Interestingly enough her behavior showed increasing integration as she grew older. She therefore seemed somewhat more mature without being fundamentally any more advanced in her capacities. This modest but constant gain in poise and integration is an expression of her original normal endowment, an indication of the child she should have been.

The irregularities in her performance are more or less characteristic of injury. At 3 years motor behavior was atypical, language behavior was near 15 months, her adaptive behavior was roughly in the 18 to 21 months zone while personal-social behavior was distributed in the 21 to 24 months zone. The texture of her behavior was like a poorly woven cloth; there were dropped stitches, holes and gaps. At 6 years, in spite of the increased integration, performance is still uneven and irregular.

Figure 13 illustrates this deficiency in organization. It reproduces diagrammatically the scoring of her examination behavior. The scor-

ing is here stripped of its context and reduced to its simplest terms. a solid cell represents an established behavior pattern, an open cell represents the lack of an ability.
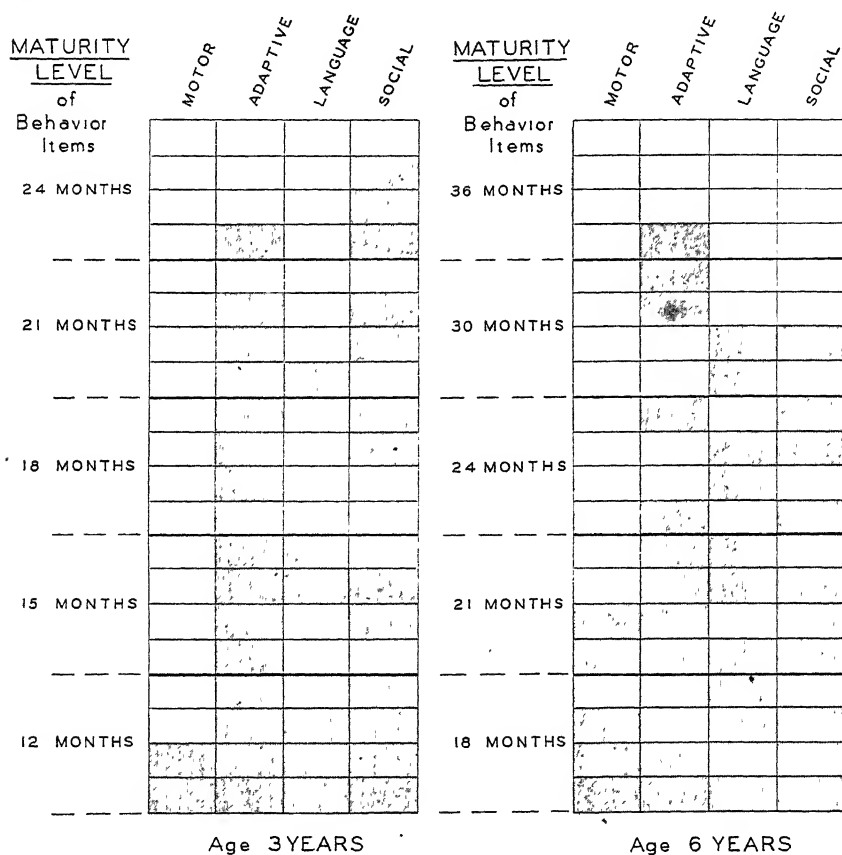
FIG. 13. Diagrammatic representation showing the behavior organization of Case 6 at 3 years and at 6 years of age. Solid cells represent an established behavior, open cells lack of behavior in a given field. The behavior at 6 years is somewhat better integrated but, relative to age, not more advanced.

CASE 7 is an unusual example of selective cerebral injury. The motor disabilities are considerably less than in the three previous cases, but the total symptomatology is too severe to be classed as minimal.

This child was delivered after a normal gestation by low forceps with episiotomy. The cord was coiled about the neck. Crying was

spontaneous; the birth weight was 7½ lbs. She was a very good-natured baby and while her parents considered her alert and responsive, they also recognized that her behavior development was very retarded.

She was referred for developmental examination at the age of *40 weeks* because of her failure to sit and to hold up her head. She was a large well-nourished infant. Her face wore an extraordinarily bland and sober expression due to excessive relaxation of the facial musculature. Muscles of the back and neck were similarly relaxed so that she needed firm support in the sitting position and her head drooped forward. Arm and leg muscles were hypertonic: the arms were held in flexion, the hands fisted; the legs in extension, the toes in tonic plantar flexion. The deep reflexes were hyperactive.

At the test table her prehensory movements were slow, labored and leaden as though she were perpetually embarrassed by the force of gravity. She never lifted her hands from the table surface but she seized the cube with a radial palmar grasp, the pellet with raking flexion followed by an inferior scissors grasp. Her prehension had an asynergic stilted character without smooth blending of the component parts.

Motor co-ordination difficulties have characterized her entire development. Maturation continues at a sure though retarded pace and she masters, in her own way, many of her motor problems as she goes along; but she never catches up with the most recent ones. She suffers from a selective damage to the neurological equipment governing the tone synergy, timing and co-ordination of voluntary movement. Even her attentional and emotional characteristics reflect this central lack of control. Her handicap shows itself in retardation and distortion of posture, locomotion, manipulation, articulation, the motor aspects of adaptive behavior and in personality disorder, although in insight and intelligence this girl has been distinctly normal and above rather than below average in caliber. Even on her first developmental examination at 40 weeks, her adaptive behavior was well above the 32 weeks level.

The general course of her development can be briefly summarized.

Motor behavior. At one year she sat alone, leaning forward on her hands, and she could stand holding the crib rail. At 15 months

she crept but in an extraordinary manner, without rearing her head, and she cruised about by the furniture. At 24 months she walked, her head hanging down. At 30 months she walked with head retracted, looking at the ceiling. This uneven, reciprocal imbalance of flexors and extensors has been characteristic of her neurological development. At this time her manipulatory and locomotor movements first showed true, though relatively mild, athetosis. At 3 years she was able to run unsteadily and heavily. At 4 years she stood waveringly on one foot. Hand movements are uncertain and poorly controlled; at 5 years her drawing of a man is correctly detailed but very crudely executed due to the aberrancy of her movements.

Adaptive behavior. In spite of the motor disability which often gave an infantile caste to her behavior, this girl has from the beginning shown undeniable evidences of normal intelligence and even of superior potential ability. She has a good sense of form and balance despite her failures to achieve these qualities in her own movements. She is fond of books and likes to be read to. Reasoning ability and intellectual curiosity are well developed.

Language behavior. Comprehension of language has been far in advance of her ability to express herself. For a period she relied heavily on highly expressive gesture. At 15 months she said "dada"; at 30 months she had a vocabulary of 25 words and was beginning to combine them. At 5 years she defined a chair with superior analysis and abstraction. "A chair has legs, a body, and a top." Articulation is explosive and she stutters.

Personal-social behavior. In basic temperament this girl is amiable, reasonable, and sociable. As an infant she showed a quiet unexcited perseverance in attempting to overcome her postural and manual difficulties. As she has grown older, however, and social adaptations of increasing difficulty have become necessary, she has shown another aspect of her disability. She is unable to meet the normal life situations of growing up in a normal way. Behavior problems have arisen on all sides: she is over-excitable and becomes silly and "naughty," or even destructive and aggressive under quite normal social pressures. She indulges in strange phantasies, strange emotional attachments to objects, equally strange fears of inanimate objects. She has failed to adjust to kindergarten.

The pathway of her development has not been and will not be an easy one. Her motor disability is relatively mild and is due to selective damage to the basal ganglia. However, motor functions are so pervasive that the whole complexion and patterning of personality have been affected, perhaps not calamitously but certainly not benignly. Indeed, as suggested in the previous chapter, the organization of personality is dependent upon the integrity of neurological structure, because personality in a psycho-somatic sense has its seat in the total nervous system. Even if we concede this girl's conduct to be in the nature of an inferiority reaction, we are only saying the same thing in another way.

Practical Corollaries

The examination of a child with motor disabilities always presents practical problems in management and in diagnosis. The examination arrangements must first be adapted as much as possible to meet the handicap. If the child is unable to sit alone, adequate support must be provided: an armchair may suffice; or a high chair and table (pictured in Appendix C) may be necessary; he may need to be tied in his chair or he may need to be held and supported in the sitting position. Rest periods during which the child is permitted to lie back often permit him to renew his attack on the examination with revived zeal and interest.

Then the application and interpretation of the examination situations may require adaptation to the child's disabilities. It is often difficult to distinguish between a performance which fails for mechanical reasons and one which fails from lack of insight and maturity. Is the child with cerebral palsy who fails to build a tower of 6 cubes too handicapped to place his cubes accurately, or does he lack the fundamental maturity to make such a structure? Is his inability to imitate a stroke due to manual inco-ordination or to retardation? We can hardly expect a hemiplegic infant to transfer a toy from hand to hand. The interpretation of each performance must rest upon its own merits. Evidences of insight or of effort should not be overlooked; some children will not even attempt a task when it is clearly beyond their capacities. The examiner should offer such assistance as the child will accept, encourage effort and even reward effort with deliberate success if these measures will

help in eliciting concealed abilities. Errors are probably more frequently made in excusing failure on the ground of motor incapacity than in penalizing a child because of motor incapacity. Errors in either direction are, of course, unfair to the child. Tests that are clearly impossible in the face of the specific handicap should be omitted. Snap diagnoses on the basis of a single examination are to be avoided; often repeated observations over a period of many months are necessary to establish the developmental outlook.

In addition the diagnostician is often called upon to distinguish between primary defects and anomalies of the central nervous system, and acquired defects. In many instances it must be admitted that a distinction cannot be positively established. The presence of other congenital anomalies and stigmata always points toward primary developmental defect. Marked unevenness of development or scattering with normal behavior residuals as illustrated in Case 6 always points toward acquired defect. Irregularity and asymmetry in the distribution of motor signs is additional evidence of secondary damage. Primary defects tend to be more even and generalized. The birth history alone is an extremely unreliable indicator. Disturbances in the neonatal period may occur in either an inferior organism or a damaged organism.

The etiology of the disabilities in Case 7 is perhaps open to some discussion. In favor of the primary defect category is the apparently normal birth reaction and the normal neonatal period; athetosis and personality disorders are not incompatible with a primary defective organization of the central nervous system.

In favor of a diagnosis of secondary defect, on the other hand, is the normal family history, the history of rapid (4 hour) labor terminated by forceps delivery even though "easy," the coil of umbilical cord about the neck, the absence of stigmata, the excellent physical development and the superior intelligence. The presence of motor and personality deficits, the irregularities in behavior development, and the underlying evidences of original normality weigh the scales heavily toward acquired defect.

Practically the question becomes at times almost academic. It is far more important to determine the extent and seriousness of the handicap and its effect on development; the essential thing is to appraise

the child in terms of his equipment, his developmental potentialities, and his social adequacy.

In general, temperamental characteristics are usually the least affected by cerebral injury. The child has an underlying individuality which makes itself manifest. If the endowment is superior and vital the child maintains a chronic contest with his disability and develops devices for overcoming it. This is particularly true of selective injury with marked motor disability. The spastic athetotic child has such poor command of his effectors that he cannot imitate the movement patterns of the cultural environment. He has no latent neuro-motor equivalent for the cultural pattern in his own neuro-motor make-up. Such equivalents are the basis of imitation in the normal child. Lacking these resources to draw upon, the palsied child has to become an innovator. This demands high intelligence and spirit. He becomes a kind of pioneer in his efforts to work out a communication code. This extra task constitutes an extra load. Normal progress of development is impeded. Incidentally the household must meet him half-way in order to interpret his efforts to communicate. We have learned through clinical experience to have increased patience and some added optimism with respect to these early years. Sometimes as much as five years must be allowed before a motor handicapped child finds himself.

The motor co-ordinations characteristic of the first year of life are probably easier for him to approximate than the co-ordinations of the years which follow. Even after he has had some success in taking the first developmental step he finds himself in increasing difficulties in taking the second step. This is not surprising because even for the normal child with an intact nervous system the multitude of motor achievements peculiar to the second and third years of life are hard to master.

The expression "finding himself" is somewhat vague but it has a clinical and anatomical basis. When cerebral injury is so profound that it damages even though subtly the deep-seated psycho-motor patterns which are at the basis of integration and attentional adjustments, the child may never altogether find himself. His personality problems persist and reappear in changing forms, because his personality is so bound up with these psycho-motor patterns. If, however, the damage is not so deep-seated, he improves his integration

and rewards the special efforts which are expended in physiotherapy and in special educational programs.

§ 5. MINIMAL INJURY

The concept of minimal injury has been gradually forced upon us by our clinical experience with atypical infants. Definitely retarded and definitely palsied infants were readily classified on the basis of conventional categories. There were other infants whose behavior deviations could be ascribed to inborn temperamental characteristics, to external environmental factors, or to faulty management. But by exclusion there remained a sizeable group of cases which presented atypical syndromes that could only be accounted for on the basis of mild or resolving injury.

The diagnosis of minimal cerebral injury is not always supported by the birth history and neonatal history. The diagnosis rests upon the nature and the historical development of the behavior deviations and deficits. Here, as elsewhere, one must take the total behavior picture into account and must reconcile the findings of successive examinations. Even when there is a portentous birth history which would seem to point unmistakably to devastating or selective injury of severe degree, it is well to place the utmost reliance on the behavior picture. We shall presently mention a case in which there was a quadruple skull fracture at birth, but which very early earned a diagnosis of minimal rather than severe injury on the basis of developmental diagnosis.

On the other hand, an entirely negative birth history and an uneventful neonatal period may nevertheless demand a diagnosis of minimal injury because of persisting or gradually diminishing behavior signs. In obscure or doubtful cases the following is a safe rule: Do not assume that there has certainly been a cerebral injury, but assume that every child who is born alive has run the universal risk of such injury.

Two limiting considerations might be added: (a) other conditions equal, the risk is least for children with superior endowment and high grade potentials; (b) the consequences of very slight injury are greatly aggravated by emotional sensitivity in the child and by faulty environment and care. After extensive experience with the obstetrical aspects of birth injury, Ehrenfest came to the almost

paradoxical conclusion that intra-cranial hemorrhages are so com-
mon in first-born infants that they may be regarded as normal. From
the standpoint of developmental diagnosis one might postulate that
all children, whether first-born or not, actually suffer some degree
of natal injury; but the vast majority of normal and fortunate infants
have mechanisms of adaptation which result in prompt recovery.
The minimal injury group consists of those children who make a
slow or delayed recovery or who present persisting behavior residuals
consequent upon inferred injury.

CASE 1. This case presents severe natal history with evidence of rapidly
resolving cerebral injury. The birth was at full term, weight 7½ lbs. High
forceps were applied with difficulty, resulting in fractures of both parietal
bones and of the occipital bone, confirmed by x-ray and by bleeding
from the ears. The head was extremely contused. Two days after birth
the infant was apathetic, listless, flaccid, hypersensitive to handling.
Neurological examination at the age of 2 weeks was negative, but the
infant was almost completely unresponsive during the first month of life.

She was referred to us for developmental examination at the age of
34 weeks. At this time she showed well maintained interest and attention
to the demands of the examination. She was slightly retarded in postural
control and somewhat advanced in her adaptive behavior. She rated at
a full average level from the standpoint of maturity of performance.
However, there were several residuals of cerebral injury. Her sitting was
of the narrow base adductor type. She showed excessive unilateral prefer-
ence in the use of the right arm and a tendency toward tonic plantar
flexion of the toes. Her deep reflexes were hyperactive, especially those of
the left arm which was weak. Supine performance was superior to her
behavior at the test table, a discrepancy which is of symptomatic sig-
nificance. There was a tendency to hyperextension with over-reaching
before grasp, and also after release. In her approach upon the pellet she
pushed it with her index finger, approximating the thumb but without
flexing the conjoint digits,—a somewhat anomalous pattern noted in sev-
eral other cases of suspected cerebral injury. Although her eyes wore an
alert expression, there was a definite tendency to a blanking out of facial
expression, strongly suggestive of weakness of the facial muscles.

Re-examination at the age of *1 year* again showed a full average level
of maturity. She was then a big, healthy, happy, vocal infant, deliberate,
poised and self-controlled. She made an excellent adjustment to the ex-
amination. With the exception of a slight retardation in gross motor con-

trol, the behavioral residuals of cerebral injury had almost completely disappeared. She no longer sat on a narrow base; she used both hands equally well; there was only a slight tendency toward plantar flexion of the left toes; her expression was continuously alert, no longer blanked out. At 52 weeks her prehension, grasp and release were virtually normal with a slight reminiscent and exaggerated tendency to poke with the index finger. She walked at the age of 16½ months and there was no abnormality in her gait at that time.

This case will serve as a striking example of the importance of the infant's individual equation in determining his response to physical trauma. We have no means of knowing to what extent the trauma in this instance affected the cerebral substance. In all probability the edema associated with the obstetrical injury produced some of the behavior symptoms. In any event this infant displayed reserves and gave indications of the process of recovery by the end of the second week. It would not have been surprising if, in spite of these signs of recovery, she had shown physical and behavioral residuals of her early difficulties for an indefinite period. But the minor behavioral residuals noted at the age of 34 weeks are now so minimal as to be practically inconsequential. It is almost certain that within another year these residuals will have disappeared entirely. It is conceivable, however, that in a few other restricted areas they might reappear under stress, because this child undoubtedly suffered from cerebral injury, even though she achieved such a remarkable recovery in a short time.

CASE 2. The birth of this child followed a difficult dry labor. The second stage lasted for ten hours; instruments were not used. The infant cried spontaneously and immediately, but weakly. The head was markedly molded, circulation poor: generalized twitching of the left side was present for three days after birth.

The infant was referred at the age of *12 weeks* to determine whether there were any residuals of cerebral injury. She proved to be an alert, reactive infant, well up to the normative standards for her age, and advanced in her adaptive behavior. Her ocular co-ordination and perceptual behavior were distinctly superior. She showed a slight over-activity of the extensors; the reflexes were quick, brisk, and easily elicited; she startled very readily. Her intense visual interest in the cup contrasted with her failure to activate the arms or hands during regard. There was a history

of feeding difficulty with frequent refusal and spilling over, suggesting imperfect swallowing mechanisms.

These almost microscopic deviations have clinical significance. They were the expression of a slight but genuine cerebral injury which became even more obvious on the next examination at *24 weeks*. At that age there was an obvious difference between the efficiency of her ocular fixation and the awkwardness of her prehension. Her arm movements were abrupt and angular. In prehending an object, she tended to withdraw her hand just prior to contact and to extend her fingers sharply immediately after grasping. Often her grasp failed or was ineffectual. Her exploitational activity in the supine position was better than her exploitation when seated; her supported standing was superior to her sitting ability. She gagged on semi-solid food. We interpreted this as an expression of motor disco-ordination rather than a neurotic reaction; and we also suspected that it was a minimal and possibly transient symptom of underlying injury.

Examination at *40 weeks* strengthened the previous clinical impression of generally superior endowment. But again the performance in fine motor adjustments was relatively poor. The accentuated release pattern previously noted had developed into an over-individuated casting type of exploitation. Marked sensitiveness to sounds was again observed. The tendency to drool and to gag on solid foods continued.

At *18 months* her performance remains superior in all fields. She shows a mature quality of attention which is almost certainly predictive of high attainments in school and college. She has strong drives combined with sensitiveness. But she has not yet overcome her relative deficiencies in motor performance. She still shows a tendency to exaggerated extension in prehensory release, she assumes atypical everted postures of the hand, her grasping is not adept. She points to objects with a circuitous outward deviation. In tower building she flexes her hand sharply at the wrist just prior to releasing the cube, imparting awkwardness to her otherwise creditable performance. The oral musculature is still sufficiently relaxed to cause slight drooling. Her speech is definitely in arrears of her language comprehension.

All told these motor deviations are not in themselves very serious. Yet they are highly significant. They suggest some slight but fairly pervasive impairment in the mechanisms of co-ordination. In spite of the uniform excellence and energy of her performance in all other fields of behavior, she has not thus far overcome the motor crudities which have revealed themselves in manipulation, body posture, and mouth posturing. These crudities can scarcely be set down as con-

genital eccentricities, or as inborn idiosyncrasies. They are the residuals of cerebral injury dating from birth. We classify them under minimal injury because they are so mild. They may prove to be more permanent than the residuals which were described in Case 1. If permanent they may interfere with the easy acquisition of certain motor skills of work and sport in later life. In a sensitive child under certain social conditions they might have some slight influence on the course of personality development. They are minimal, but they are not negligible; they should at least be recognized for what they are.

CASE 3 illustrates the occurrence of a minimal cerebral injury in association with a negative birth history. Born out of wedlock, reared in an institution, this boy presented an amazingly bizarre behavior picture at the age of *1 year*. He sat insecurely but moved about with abandon and was almost constantly active, rocking back and forth and side to side, sucking his thumb, absorbedly inspecting his hands and his knees, scratching the table with the tip of the index finger. His preoccupation with these infantile activities was so great that he was almost completely oblivious of surroundings and persons. He could scarcely be distracted; when an object was presented he preferred to poke, tip and scratch it with his index finger.

On the developmental schedules his performance showed an extremely wide scatter, ranging all the way from 8 weeks to 40 weeks. This scatter, the normal facies, the strabismus, the marked ocular inco-ordination, the atypical hand-arm-finger patterns, and the weakness of upper trunk muscles revealed in his poor sitting,—all pointed away from a primary defect to secondary factors. The outlook was doubtful. A diagnosis of amentia was restrained in spite of the marked defectiveness of the behavior picture.

At *18 months* the picture began to assume a somewhat more normal aspect. The incessant activity, the unresponsiveness to persons and surroundings, the peculiar hand posturings though still present had somewhat lessened. His general maturity level, if one could be assigned in view of the wide scatter, approximated 12 months.

At *3 years* after long residence in an excellent foster home, the cumulative results of his beneficial experiences in this home became apparent. A remarkable transformation was evident. His motor control had improved; he articulated clearly and adjusted satisfactorily to the social requirements of the examination. Instead of retardation he showed a

well defined acceleration. In language and adaptive behavior he was rated at a level well above average.

In subsequent examinations at *4, 5, and 6 years* he has maintained this level of performance. Minor personality deviations and manner-isms persist; but the early condition of this child has undergone a profound amelioration and reorganization. This potentially normal infant suffered a minimal cerebral injury which under favorable circumstances might have resolved fairly rapidly. But the circum-stances were not favorable. The combination of motor handicaps, visual defect, and institutional environment warped and mischan-nelized the early behavior into abnormal patterns. The heedless and almost obsessive behavior he displayed at one year was character-istic of what we have descriptively termed "blind alley develop-ment." Patterns overgrow and deform instead of differentiating and individuating. We see this type of behavior in amentia, particularly in pseudo-symptomatic retardation; we also see it not infrequently in minimal injury with symptomatic complications. In this case, under the influence of time and improved environment the growth complex was so reorganized that latent potentialities were finally realized. Here an injury, in itself minimal, took on a serious aspect because of the associated factors.

CASE 4. This child first came to our attention at the age of *4½ years.* She is a good example of the persistence of behavior symptoms throughout a period of years with ultimate tendency toward resolution. There was no evidence of traumatic damage at birth. The infant cried normally and seemed vigorous. However, she showed a well-defined deficiency in her ability to nurse. This disability in the motor co-ordinations required for sucking was the forerunner of similar co-ordination difficulties which showed themselves in stammering, faulty verbal associations, delayed unilateral dominance, and in failure with simple block-building and form-matching tests as late as 4½ years; in failure with drawing tests as late as *6½ years.*

This child had been badly misjudged; the parents had even been informed by her teacher that her I.Q. was not above 65! Her early developmental course was undoubtedly atypical and she was slow to integrate her abilities, but in general intelligence she is now deci-sively normal. Potentially she was quite probably of superior endow-

ment, and even her present normal average rating should perhaps be construed as a relative retardation. In any event her normal or superior constitution has served her well in overcoming her difficulties. There have been only very minor problems in child management.

Developmental Manifestations of Minimal Injury

The problem of cerebral injury is too protean to permit of ready generalization. Even the categories of the major types of injury, namely, devastating, selective, and minimal, tend to overlap. These types, as already stated, bear no regular correlation with the gravity of the birth history. Motor and intellectual deficits and personality deviations are variable. The general trends of correlation are summarized in the accompanying table.

CORRELATES OF CEREBRAL INJURY

Severity of factors expressed as follows:
0 = Normal   1 = Mild   2 = Severe

Type	Birth History	Motor Deficit	Intellectual Deficit	Personality Deviation
Devastating	0–1–2	1–2	2	0–1–2
Selective	0–1–2	1–2	0–1	0–1–2
Minimal	0–1–2	1	0	0–1
No injury	0–1–(2)	0	0	0–1

In view of these complexities, it is natural that the diagnosis of cerebral injury is often surrounded with difficulties. In some cases the diagnostic classification of minimal injury is frankly hypothetical; it cannot be established on the basis of objective evidence, but by the process of exclusion it constitutes the most probable of several alternatives. In obscure cases the choice often lies between a diagnosis of constitutional idiosyncrasy versus minimal injury. It must be granted that a child may inherit motor weaknesses, motor eccentricities, even motor demeanors. But when these are highly atypical one is tempted to think of injury instead of inheritance. The same reasoning may be applied to emotional and personality disturbances. Therefore the diagnosis of minimal injury should be reserved for those cases in which the symptoms have a definite neurological import. The diagnosis is strengthened if the child is first-born, if he

is premature, if the birth history is at all adverse, or if there is an obscure episode suggesting encephalitis.

Minimal injuries may be so deep-seated that they affect the synergy and smoothness, albeit mildly, of all motor co-ordinations. One then finds slight evidences of inco-ordination in gross motor reactions as well as in fine motor behavior. Such deep-seated impairment, however mild, may be permanent and insuperable.

In other cases the injury may be very restricted. In early infancy the major symptom may have been difficulty in sucking. This oral difficulty may assert itself in the preschool years in a tendency to stutter. We believe there is a sizeable group of speech defects which is definitely attributable to obscure minimal cerebral injury and is in no sense the product of defective personality make-up.

More commonly minimal injuries show a tendency toward resolution and even complete recovery. This characteristic has been sufficiently illustrated in the case histories already cited. Prior to recovery the motor deficit is expressed in a developmental retardation of postural, locomotor, and prehensory behavior. Deviations in prehension and manipulation are relatively frequent and may be associated with slight oculomotor inadequacies. Strabismus is a very common symptom of minimal cerebral injury. Hyperactive reflexes and slight spasticities which undergo amelioration as the child grows older also are suggestive.

In many instances the symptoms of minimal injury are so benign that they escape attention. They are regarded as normal individual differences and are vaguely ascribed to inborn constitutional characteristics. Frequently such benign deviations are not serious. But clinically it is desirable to make a diagnostic distinction when possible between symptoms ascribed to constitution and symptoms secondary to injury. This is especially true in those instances in which a relatively insignificant injury seriously disturbs the integration and organization of the total complex of infantile development. When such insignificant injury occurs in a child with sensitive emotional susceptibilities and if this child in addition is subjected to prolonged institutional environment, or injudicious neglect or discipline in a family home, a very disturbing syndrome may be the end result (Case 3). The child may then present a remarkably atypical behavior picture characterized by fragments of normal

behavior in paradoxical juxtaposition with abnormal and subnormal behavior patterns. The general level of performance may be superficially so low that the child is even erroneously classified as an ament. With improvement in environmental conditions he may at the end of a year present a relatively normal output of behavior with but a few residuals in the form of strabismus and some slight inco-ordination of the hands. In other cases, atypical and deceptive retarded behavior continues for months and the total behavior does not show integration and reorganization until after the age of 3 years.

The type which expresses itself in speech difficulties, poorly defined unilateral dominance, and in delayed integration may later result in serious difficulty in the acquisition of reading. Oculomotor inco-ordinations and visual defects (absent in Case 4 but present in Case 3) also are frequently associated with this general syndrome. The surprising prevalence of reading disabilities, so-called, and their frequent association with minimal birth injuries tends to support our thesis that these injuries are more common than is ordinarily supposed. This circumstance lends even greater clinical significance to minimal injuries which present themselves in the first three years of life.

The child with a selective injury is usually so obviously handicapped that sympathetic understanding of his difficulties is a natural consequence. The child with only a minimal injury needs the very same recognition and understanding, and he too needs more than ordinary protection from stress and competition, particularly during the early years.

In all these cases we are dealing with an extremely complicated interaction of developmental potentialities and dynamic forces. Even though the original motor injury was mild, the damages in the personality sphere may be considerable and more or less permanent. In the interpretation of the development of these infants, psychiatric concepts are often less helpful than an understanding of developmental neurology.

§ 6. VISUAL CEREBRAL INJURY

Devastating, selective, and minimal cerebral injuries have been described in the preceding sections of this chapter. There remains a further group of children whose handicaps are due to cerebral

injury involving chiefly the visual areas. A serious visual defect is the leading and presenting symptom and these patients are referred for diagnosis as blind or near-blind infants.

Very early in life irregular, roving, or nystagmic eye movements are noted, together with failure of fixation and apparent blindness. As the weeks pass, vision tends to improve slightly though it is still obviously very poor and the irregular eye movements persist for months. The outstanding findings on ophthalmologic examination are strabismus, uncoordinated eye movements, and pallor of the optic discs. Behavior examination discloses that vision is very defective but not altogether absent, the infant cocks his head to see, the eyes rove and he sees but fleetingly: "out of the corner of his eye." He will often perceive a moving object more readily than a stationary object.

The visual defect is due to an impairment of macular vision, while peripheral vision remains more or less intact. And it is to be recalled that these two kinds of vision have separate and distinct cortical representation; thus injury to the visual cortex representing the maculae will leave peripheral vision undamaged. Peripheral vision is, however, fuzzy and fleeting; the images cannot be sharply focussed or fused and the infant cannot be said to really see or look but only to catch fugitive, blurred glimpses of his environment. In the very early weeks he hardly responds to these glimpses at all but by the age of 6 months he begins to try to use his defective visual equipment as best he can.

The infant will, at the same time, almost invariably show evidences of associated cerebral injury to the motor areas. These evidences may be only minimal but it is very important that they be recognized. The combination of visual and manual disabilities tends to distort and reduce adaptive behavior to a marked degree.

No two injuries are precisely the same and thus the clinical manifestations may be very varied. Any degree of associated motor involvement is possible and the visual handicap also varies in severity, from total blindness to such a mild defect that it is overlooked in infancy and early childhood, particularly if the motor handicap is sufficiently marked as to become the focus of attention. In other instances, poor vision is not suspected but a visual mannerism such

as eye rolling or head wagging is so obtrusive as to cause concern. Personality and intellectual deficits are not uncommon. Each case requires careful individual evaluation in terms of the total child, his disabilities and limitations and his assets and compensating forces.

A great many of these children eventually learn to use what little vision they have with considerable effectiveness and the precise degree of effective vision cannot be predicted in infancy. Most of them can walk about without guidance though they may be unsure of thresholds and curbs; they see well enough to play well with toys, though they do some clever guessing and filling in. Books and pictures are beyond their visual abilities as a rule, though many will pretend to read and will supply random names for the pictures they cannot see.

Treatment directed toward the conservation of sight is indicated. If the child is tending to establish monocular vision, vision in the nonfunctioning eye should be preserved by covering the good eye with an eyepatch for one or two daily periods as tolerated by the child. And he will tolerate the patch if he has any vision at all in the nonfunctioning eye, though he may need considerable help. An ingenious and conscientious mother will find that even a small infant will wear the patch if he is riding in his carriage or if she will give him extra attention and stimulation at this time. Operative correction of the strabismus should not be attempted too early and should depend entirely on the ophthalmologist's judgment as to its chance for success. Corrective lenses should be applied for any coexisting error of refraction but the parent should be warned that the visual defect is central and not in the eyes themselves and that very little improvement in vision is to be expected from glasses. At school age, sight conservation class or special school for the blind may be indicated.

The parents need orientation and education. They must learn to think of their child, not simply in terms of his eyes but in terms of his total make-up, including his associated handicaps and assets. Many of these children do quite remarkably well from a developmental standpoint; great conservatism should be exercised in pronouncing adverse judgments in the early years.

§ 7. ILLUSTRATIVE CASES

CASE 1 had a normal birth but was cyanotic for the first 12 hours of life. Irregular eye movements and failure of visual responses were noted early. Eye examination under anaesthesia at 4 months of age showed pallor of the optic discs. In time vision improved slightly but the parents became concerned about the baby's poor developmental progress.

At *44 weeks of age* the infant had marked strabismus with wandering of the eyes. She cocked her head in attempting to fixate, saw very poorly and groped for objects. Her sitting posture was abnormal, unsteady with bowed back. The arms were tremulous with small athetotic finger movements. She held two objects, grasped and transferred awkwardly from hand to hand. General maturity level 32-36 weeks.

At *15 months of age* she crept and pulled to her feet. Her exploitation was stereotyped, her prehensory approach tentative and over-deliberate. On one occasion she attempted to build a tower of two cubes. She had 3-4 single words and a limited soft jargon. General maturity level approximately 13 months. She had numerous visual mannerisms as pulling and poking at her eyelids and the bridge of her nose. The abnormal eye movements were no longer present but she was using only monocular peripheral vision. Reexamination of the eyes under anaesthesia at this time revealed some pallor of the discs, with probable defect in the central area supplied by the *papillo-macular bundle.*

At *27 months of age* she is walking alone. Her gait is somewhat stiff and rigid, a little too erect. She does not grope her way but is unsure of thresholds and often drops to her knees and creeps through a doorway. Hand movements are uncertain and she over-reaches and fumbles. She has about 10 words. General maturity level 18-21 months.

The ultimate developmental outlook is still uncertain. The visual handicap remains severe while the motor signs of cerebral injury are becoming decreasingly significant, though they were striking enough in infancy. This child may prove to be moderately retarded, or she may further organize and show improvement.

CASE 2 was born normally at term. She required resuscitation and showed cyanosis and feeding difficulties in the neonatal period. She was referred for examination because "the eyes roll in a purposeless way, less marked now than formerly. Does not recognize her mother."

At *26 weeks of age* she was a small infant with a small head and obviously poor vision. There was strabismus and occasional saccadic movements of the eyes. Tone was greatly excessive and the reflexes on

trigger. Her adaptive behavior was almost entirely confined to stereo-typed hand regard or pseudo-hand regard and she apparently did not perceive proffered toys. There was no grasp, the hand remaining open when an object was pressed against the palm. Head control was very poor. She chuckled and cooed. She was reported to have made great progress in the month preceding examination but she had attained a developmental level of only 12-16 weeks. The ophthalmologist reported that the central areas of the fundi of both eyes showed a granular atrophic lesion of the choroid and retina, together with pallor of the nerve heads.

At *42 weeks of age* strabismus was marked, vision just barely adequate for grasp and exploitation. She could sit alone briefly, creep, and pull to her feet. Hand regard was still present and there was considerable fine motor incoordination. Hypertonia and hyperreflexia persisted. General maturity level close to 36 weeks. The outlook seemed much improved.

At *15 months of age* she walked alone with a toddling gait. The manual disability was very slight. Strabismus was, however, very marked and she used only the right eye. A slight left facial weakness and some general blanking out of facial expression were apparent. Her performance was normal in quality, the general maturity level 13-14 months. She was wearing an eye patch over the right eye about one hour a day, tolerating it with social help. She was sufficiently "wise" to go into a corner to try to pull it off.

At 2 years of age the position of the left eye was surgically corrected with 90 per cent improvement.

At *26 months of age* her gait is entirely normal, if a little cautious, and she uses her hands well. Vision is adequate for walking about and manipulation of objects, inadequate for picture identification or demonstrations with blocks and formboard. General maturity level 21-24 months.

The developmental outlook is relatively favorable; there remains a considerable visual defect which will have to be taken into account in planning for her education. Her development has far surpassed anything that could have been predicted on the first examination at 26 weeks of age. Most remarkable is the recession of the motor signs of cerebral injury.

CASE 3 was born two months before term due to premature separation of the placenta. Labor lasted three hours and low forceps were applied. The infant did well but at the (corrected) age of 5 months the mother was concerned because he frequently rolled the eyes downward and

inward as though looking at the end of his nose, and appeared to lapse into a "dream state." The referring physician considered the behavior sufficiently abnormal to suspect a disturbance in vision.

At the (corrected) *age of 25 weeks* he was a passive, chubby, inactive infant with poor head control and poor vision. The arms were held flexed and withdrawn with athetotic movements of the fingers; the legs and toes were held extended. The reflexes were hyperactive. There was no prehensory approach, simply vague, passive regard. He displayed a frequent mannerism, looking down his nose with marked strabismus and general immobilization. The behavior was very atypical and no patterns above the 16 week level were seen. Feeding difficulties, choking and gagging, were reported as prominent.

At the (corrected) *age of 40 weeks* he did not respond to toys at all unless they were moved and shaken, when approach would suddenly break through his passive immobility. Grasp was poor and objects seized were immediately dropped. He could sit alone very momentarily. Adaptive behavior was depressed to the 24-28 week level, while language behavior was nearer 36 weeks. A report from the ophthalmologist stated "probable optic atrophy."

At the (corrected) *age of 17 months* he could take a few uncertain steps alone. When the right hand was held to assist his walking, the left arm reflexly assumed a typical hemiplegic posture. He used the right eye only, cocked his head, and strabismus was marked. The hands frequently assumed athetotic postures. General maturity level 52-56 weeks. Eye patch treatment was begun at this time.

At the (corrected) *age of 30 months*, motor signs were almost imperceptible though he still choked on solid food and the hands were perhaps a little clumsy. Vision remained very poor and was not quite good enough to enable him to respond to many of the examination situations. He did not see any demonstrations not involving movement (as drawing). General maturity level 24 months + but language was lagging with a vocabulary of only 3-4 words. Wearing eyepatch 1-2 hours daily.

At the (corrected) *age of 4 years* he has a free, easy stride, but his hand movements are not quite precise. Feeding difficulties have finally resolved. His attention is fairly well sustained and language development has accelerated; he has a fairly good vocabulary and uses sentences. Vision is very poor and he does much covering of his visual inadequacies with random replies and evasive remarks, though he occasionally admits, "I can't" or "I don't know." He is actually so adept at concealing his visual handicaps under ordinary conditions that the mother says, "He seems to see all right at home. Perhaps I overestimate

but I don't think his vision is so bad." Adaptive maturity level 3 years, language development 3½ years. Operative correction of the marked strabismus is planned in the near future.

This boy undoubtedly sustained cerebral injury with mild motor involvement and with marked visual involvement. It is still difficult to estimate his maturity with any assurance that one is doing the boy full justice. The visual handicap is serious and will create special problems in adjustment and education.

CASE 4 was born 3 weeks postmaturely, weighing 7 pounds and 1 ounce. The birth was instrumental; the infant was cyanotic and twitched for the first 24 hours of life. She had a single convulsion at 11 months of age. She was referred for examination at *18 months of age* because she could not stand or walk.

She had a spastic monoplegia of the right arm and hand with associated signs of further mild, diffuse motor involvement. She used her left hand poorly, tapping, pushing, and poking at objects without coordinated manipulation. She walked when one hand was held, overstepping with the right foot; she could not creep or pull to her feet. The reflexes were hyperactive, the right more so than the left. Her regard was vague and vision defective. She tended to fix with the left eye, the right eye wobbling uncertainly. She had a rich jargon and 15-20 words. Gross motor development atypical, fine motor 40 weeks, adaptive 10-13 months, language 18-21 months.

Her progress has been remarkably good and on her last examination *at 5½ years* the gait is normal except for over-cautiousness on stairs. She uses her left hand almost exclusively, bringing in her spastic right hand to steady the unsteady movements of the left. Vision is poor; she picks up the pennies, one by one, leaving two unseen on the table. She verbalizes drawing a man but the drawing is totally unrecognizable though she is quite satisfied with her product. She identifies large pictures not too accurately. She guesses, fumbles and gropes; she makes excuses, "It's hard to do," "That's the way I do it," "What's the matter with this thing?" At the same time she handles all the language and conceptual tests appropriate to her age with ease. She has been wearing glasses for two years with very little if any improvement in vision.

This child has a selective cerebral injury but the visual injury, which was unnoticed for the first 18 months, is now her most serious handicap. She is ready for school entrance but will require special educational measures adapted to her manual and visual disability.

CHAPTER XIII

BLINDNESS

The development of vision in the individual child is complex, because it took countless ages of evolution in the race to bring vision to its present advanced state. Human visual perception ranks with speech in complexity and passes through comparable developmental phases. Moreover, seeing is not a separate isolable function: it is profoundly integrated with the total action system of the child—his posture, his manual skills and coordination, his intelligence and even his personality make-up. Indeed vision is so intimately identified with the whole child, that we cannot understand its economy and its hygiene without investigating the whole child. For this reason even minor defects, whether sensory or motor, in the function of vision have importance for the pediatrician as well as for the ocular specialist. The grave defects of blindness and near blindness reveal the significance of visual perception in the economy of child development.

The appraisal of the developmental capacities of a blind child is a challenging task. The examiner should not assume that the ordinary methods of developmental diagnosis are inapplicable. Many of the situations can be adapted to the handicap. Other situations can be improvised by following up the cues of the child's spontaneous behavior. Postural, prehensory, language, and personal-social behavior patterns which require little visual discrimination can be observed and in part elicited. All successful performance which approximates the child's age should be weighted very favorably as a maturity sign. The interview should be made penetrating to bring to light the maximum manifestations of adaptive behavior at home.

Even the blind child has the progressive ability to meet the basic

tests of life, if he is otherwise normally endowed. A chief purpose of the developmental examination is to appraise this ability in terms of personality as well as of actual performance. Some of the child's failures and difficulties must, of course, be ascribed to his handicap; but too much allowance should not be made for the retarding effect of the blindness per se. If he has normal potentialities he will demonstrate them in his drive, in the purposefulness, relevance, and integration of his behavior, and ultimately in his ability to establish a working rapport with parent and examiner. If his behavior is fragmentary and poorly organized; if it is excessively self-absorbed and undirected, the outlook is not promising, even though the child is active and is responsive to a few well learned situations. However, the factors which determine the developmental fate of a blind infant may be so various and numerous, that prognosis should be cautious and conservatively hopeful, without fostering undue optimism. The first illustrative case listed below demonstrates that even in combination with extreme prematurity, blindness does not necessarily produce serious retardation.

§ 1. DEVELOPMENTAL ASPECTS OF VISION IN INFANCY

Vision is the most sophisticated and objective of all the senses. It gives the most detailed report of the outside world, simultaneously registering position, distance, size, color and form. But vision does not function in complete isolation; developmentally and psychologically it is closely correlated with other sensory activities, particularly touch and kinesthesia. Blindness therefore constitutes more than the mere absence or impairment of a single sense. If it dates from birth or early infancy it drastically dislocates the entire mental life of the individual. The total complex of growth is altered. The retention of hearing does not fully compensate the infant, because the interpretation of what he hears depends so much upon what he is deprived of seeing. Contact with the social world also is handicapped. Vision is a social sense as well as an intellectual sense. Even though the infant is not wrapped in silences he lives in a world of visual nothingness which threatens to drive him into increasing introversion as he matures. The organization of his personality is more endangered than his intellectual development.

In its development vision is more precocious than audition. The

infant is born with visual hunger. Although he resists excessive il-
lumination by blinking, he very soon uses his waking time for the
accumulation of visual experience and the exercise of ocular func-
tions. Indeed, so fundamental is the sense of vision that it is the
traditional criterion of wakefulness as opposed to sleep. An infant
does not really wake up until he begins to look; and when he ceases
to look he goes to sleep.

In the early months looking is half of living. Prior to the fourth
week he follows a moving object through an arc of 90°. At 12
weeks he follows it through an arc of 180° with some competence.
By 16 weeks he has excellent command of his visual apparatus and
can rotate his head freely from left to right. He can even detect a
pellet on the table top.

From the very beginning there is a motor component in his visual
behavior. The eyes do not function as mere receptors which catch
rays of light. The eyes are search-light antennae which are in con-
stant adaptive movement. The kinesthetic impressions which are
registered by these eye movements are as essential as the retinal
impressions themselves, because the retinal impressions in isolation
would not supply the data which are necessary for comprehension
of the configuration of physical objects. The motor data furnished
by the eye muscles are soon supplemented by comparable data
supplied through prehension and manipulation and soon thereafter
through locomotion. What the infant sees depends on what he does.
Visual impressions supply the foci and cues for attentional fixations;
but the infant's knowledge of the physical world is built up through
the dynamic adaptations of the organism as a motor reaction system.

This brief survey of the normal course of the development of
vision serves to show how pervasive and profound must be the
psychological modifications produced by visual defects. The whole
perceptual and emotional life is involved. So-called visual percep-
tions are really visual-motor perceptions. Even in the normal infant
they are products of long and gradual growth. The retina receives
impressions, but muscles, fundamental and accessory, achieve the
adjustments to position, distance, size, and form; the cortex organizes
the experience. The blind infant cannot attain even the most rudi-
mentary spatial orientations until he can bring his muscular system
to bear upon these same problems of position, distance, size, and

form. But for him they will always be different problems, because he cannot use sight and motor response in mutual self-correcting combination and reciprocal reinforcement.

For this reason the retention of even a very slight amount of vision in a visually defective child has an extremely favorable effect on his psychological organization. This fact should be borne in mind by the physician. Any therapeutic or surgical procedure in infancy which will bestow even a modicum of sight is paramount above all other measures.

It is unfortunately true, however, that any primary or secondary damage to the visual receptors is extremely likely to involve other structures of the brain to the extent of producing amentia. The restoration of some vision, therefore, does not always insure a favorable developmental outlook, even when accomplished early.

One sense cannot substitute for another; one sense can never adequately compensate for another. It is very doubtful whether there is any considerable increase in constitutional acuity of the senses which remain intact. Sensitivity as such is not increased by way of compensation. Sense perception is developed through the progressive acquisition of associations and meanings. The senses were meant to function in synesthesia, two or more modalities blending. Even the primary tactual sense does not normally function in pure form. Tactual perceptions are visual-tactual perceptions for the normal mind. If this close reciprocal interacting relationship between vision and touch is not recognized, it is impossible to appreciate the gravity of the handicap under which the blind or near-blind infant labors.

Hearing is a distance sense for the seeing child. But for the blind child hearing is an extremely subjective sense. Sounds do not acquire objectivity, localization and distance meanings except through long and tedious training via the tactile route. Like proprioception, even tactile sense-perception tends to remain highly subjective for the blind child. It is difficult for him to give tactile impressions an externalized realistic content. When he acquires the spoken word he has the same difficulty. Whether he speaks the word himself or whether he hears it spoken by others, it is difficult for him to give it an objective, detached status. He uses words for self-satisfaction and even when he is mature, he has difficulty in overcoming a sub-

jective kind of verbalism. Psychological forces tend to drive him
into introversion. His major developmental problem is to achieve
some degree of extroversion. The whole policy of management should
be based upon this central developmental fact.

The blind child is so dependent upon touch that it is difficult for
him to project his mental constructs beyond the periphery of his
reach. As an infant he has more difficulty than the seeing child in
attaining a perception of his physical self. His physical self is am-
biguously involved with garments and with blankets and with
furniture. He has not the assistance of sight to make the funda-
mental distinction between his anatomical self and all these appur-
tenances. For the same reason he must have profound difficulties in
building up images appropriate to the voices which he hears and
indeed in associating these voices with persons like himself. He
lives in a world of voices, but the voices come out of nothingness
and they go back into nothingness.

Like the normal child he can come to an appreciation of distance
and intervening space only by translating his body from one point
to another. He begins to acquire a dim sense of remote objectives
and of distance covered if he is permitted to creep and to walk.
If, as so often happens, even his locomotion is restricted or denied,
his spatial orientation remains benighted. The mastery of those
finer details of distance and of spatial relationships which we call
form likewise is dependent upon ample exploration through active
touch. His finger tips must make journeys to explore outlines and
conformations. Here again it is easy to underestimate the depth of
the blind child's deficiency. Even the seeing child, as the develop-
mental schedules indicate, comes by slow degrees to the concepts
of vertical, horizontal, circle, square, oblique, etc. Indeed his retinal
maculae do not attain full physiological development until about
the age of 7 years; all of the intervening years are necessary for
acquiring the minutiae of experience which establish the precision
and the dimensions and the stereoscopic qualities of his perception.
In this long developmental stretch he is continuously assisted by the
critical side light of detailed vision.

It is fatuous to hope that the blind child will ever attain equally
penetrating and rich mastery of detail. If the blind child does not
know what an elephant is, it is idle to suppose that in his preschool

years he will learn what an elephant is by presenting him with a miniature model however attractive and convincing the model may appear to the seeing eye.

In discussing the handicap of the deaf child we use the metaphor of the motion picture film. We may also adapt the metaphor to the blind child. For the blind, the sound film is a succession of jumbled sound effects and a running commentary of words. But he lacks all experience of the pictorial patterns and the pageantry of gesture and of movement which constitute the essence of the film for the deaf and the normal child.

These handicaps are most characteristic of the congenitally blind and of those who come by their defect in early infancy. But, happily, if the child has sufficient vision to serve him at all for perceptual purposes, he tends to develop like a seeing child. We recall an infant girl who was born with bilateral cataracts, but who had some faint light perception in infancy. She played actively and showed great eagerness for visual experience. She would grope for a toy, grasping it on tactile cue, and locating its position by an auditory cue, when the object made a sound as it was placed on the table. Having grasped the object she brought it very close to her eyes, examining it in a monkey-like manner. Her investigatory drive was so strong that she fussed in the absence of toys. At the age of one year she picked up a pellet on tactile cue, using a scissors type of thumb opposition. It is noteworthy that she had developed such a high degree of fine prehension, even in the absence of detailed visual experience. She made an excellent showing on the developmental schedules at the age of 18 months just prior to the needling of her cataracts. Vision was improved by the operation and by glasses. She has made excellent progress, maintaining the alert facies and happy disposition which she manifested as a baby, and rating near an average maturity level at the age of 4 years. She represents the type of child who will not need to be sent to a school for the blind, but who will greatly benefit from the specialized instruction offered by sight-saving classes.

§ 2. The Diagnosis and Early Management of Visual Defect

The primary diagnosis of visual defect in infancy is relatively simple; there is imperviousness to the flashlight, absence of protective

blinking, and incapacity to follow a moving object with responsive head or eye movements. These constitute sufficient evidence of complete or partial blindness. The estimation of the degree of residual sight is a more difficult matter and needs no discussion here. The gravity of any sensory defect, however, cannot be appraised purely in terms of sensory acuity and sensori-motor inefficiency. The total effect upon the developmental organization of the child is most in need of critical diagnostic appraisal. This total effect can be estimated on the basis of the developmental examination and developmental interview. An interpretive diagnosis of behavior symptoms must determine the procedures of care and management.

The diagnosis of strabismus is a problem of some importance. Its significance as a neurological symptom has already been mentioned. In normal infant development, the eyes are usually well co-ordinated for conjugate movements by the age of 12 weeks. Persisting or recurrent strabismus beyond this age cannot be dismissed as negligible. The causes which make for deviation are various; but it should be remembered that the normal forces of growth regulation place a premium upon symmetry of alignment and on balance of motor control. Under the influence of these forces, many cases improve during the first year; but a significant proportion figure later as the obvious or pronounced cases which ordinarily do not come to the ophthalmologist until the age of 2 or 2½ years. Prior to this age, the difficulty may yield to treatment, either through the fitting of glasses, covering the affected eye, or even surgical correction. It is well to bear in mind that some cases respond very satisfactorily to the cover method, which is designed to prevent the development of *amblyopia ex anopsia*. And it should also be remembered that in some cases correction of refractive errors may cause the squint to disappear, and that infants less than one year old tolerate glasses if they really improve vision. It is recognized that in all cases which are not self-corrective, treatment should be instituted as early as possible.

Some aments show a pseudo-blindness in early infancy. In these cases the eye movements have an uncontrolled character in the early weeks of life. They become more co-ordinated toward the close of the first year. Even protective visual blinking may be late

in appearing. The child's ability to see increases with age. His lack of response to visual stimuli is due to oculomotor retardation and to mental retardation. A differential diagnosis between amentia and true blindness must rely on a critical appraisal of the total behavior picture and the developmental history.

If, because of misguided sympathy the blind infant is over-protected, he fails to have an active babyhood; for the blind infant tends to be indifferent to the external world and his development is impeded through sheer environmental impoverishment. He becomes anemic, physically under-developed, poorly nourished, and flabby in musculature; he acquires "nervous habits." These habits are well called blindisms, although some of them occur also in institutional syndromes of children who have not suffered visual deprivation. The most common blindisms consist of eye rubbing, finger flicking before the eyes, sniffling and smelling, arm twirling, body swaying, and repetitive vocal tics and tricks.

These blindisms are symptomatic rather than constitutional. They are substitute activities. They can be prevented only if we succeed in understanding the needs of the blind child for more adequate self-expression. In the infant and preschool years very special accommodations must be made so that he may enjoy positive developmental experiences.

The blind baby needs extremely special care and yet the cardinal rule for parents should be, "Treat the blind baby as if he were a seeing child." This is a safe rule with reservations which common sense will supply. The important thing in the rearing of a blind child is the protection of his personality. This must be made strong, self-reliant, and happy. He should therefore learn to walk, even though he gets bumps; he should romp and explore and play with toys; he should be as active in body and as investigative in mind as a seeing child. He should learn to dress and undress, comb his hair, take care of his person and possessions, keep himself clean, and acquire agreeable habits of deportment. He should not be made conscious of his handicap, but rather of his obligation to take his place in the family circle. These are the primary lessons in the formation of his character, and they can be learned in a good home.

The needs of the preschool blind child are so vital that there is room here for the development of a new kind of home-teaching serv-

ice. This service as now conducted by state and private agencies is mainly confined to adults and to children of school age.

Sometimes an effort is made to provide the same educational opportunities in a special nursery or in the kindergarten department in connection with a school for the blind. Such institutional provisions seem to complicate the problems of psychological development rather than to simplify them. Institutional life multiplies the difficulties of adjustment both to the physical and the social world. The institutionalized child is confronted with other blind children equally unadjusted. An institution becomes either too stereotyped or it introduces too many uncontrollable variables, to say nothing of the confusion of noise which inevitably arises when too many children are brought into close association.

And confusion is the very thing which should be avoided in the early education of the blind. Ideally there should be a deliberate simplification of the world of sounds for the young blind. There should be fixed orientations with respect to rooms, playground, doors, and furniture. The dim world of the partially seeing should be ear-marked by certain fixed sounds such as the chime of a clock and the ring of a doorbell; it should be eye-marked by conspicuous identification disks, by spot lights which draw attention to locations.

In the early years in particular it is easy to make excessive demands. Over-indulgence should, of course, be avoided but it is better to adapt the environment to the limitations of the blind rather than to ignore these limitations. When a group of blind preschool children are gathered together there are bound to be several among them who are aggressive and hyperactive. They will hurl blocks at random; some of them will strike heads. The blind child cannot learn the course of a projectile from such experiences. He makes no association between throwing a toy and being hit by a toy. These recurring mishaps are lawless, uncomprehended and emotionally disturbing. Well-defined and simplified educational paths must be laid out; the protectiveness of intimate individual guidance is needed. When an adult is at hand to safeguard, the blind baby may be encouraged to creep and the toddler to walk. Self-confidence is imparted by progressive stages, with not too much reliance on the hard knocks of experience.

Such individual guidance is best realized in a family home. If the

blind child is deprived of parental care, foster home placement is much preferable to institutionalization. Expert educational guidance can be provided both for foster and family homes through home visitors trained to understand the peculiar needs of the infant and preschool blind. The early years are most in danger of neglect and of misguided treatment. Every case presents individual problems which demand the counsel of the physician. A knowledge of the developmental characteristics of sensory defects will enable him to render invaluable service.

§ 3. ILLUSTRATIVE CASES

CASE 1 was born 13 weeks prematurely, with a birth weight of 2 pounds (999 grams). Although slightly cyanotic, and afflicted with atelectasis and cervical adenitis during the neonatal period, she made excellent physical progress, and at the age of 35 weeks weighed 15 lb. 10 oz. (7100 grams), approximating a weight norm of 24 weeks and a height norm of 20 weeks. This was consistent with a corrected chronological age of 22 weeks (35 minus 13 weeks). A developmental examination at that time showed a behavior picture approximating the 20 weeks maturity level; this in spite of almost complete blindness. Flashlight inspection through the constricted pupils of both eyes revealed a whitish membranous sheet posterior to each lens: *bilateral retrolental fibroplasia.* The infant showed slight sensitivity to strong light, indicating a small residuum of vision. In the supine position, she extended her arms laterally, pumped with both feet, rolled to the side, squealed with pleasurable vocalization. She brought hands to mid-line when examiner pressed a rattle against chest. Seated in the supportive examining chair, she actively exploited the table top with scratching and incipient groping and corralling approach to cube, grasped cube on contact. She noticed her mother's voice and quieted when talked to. *Prognosis,* favorable because of drive, integrativeness, and satisfactory personal-social adjustments.

Reexamination at 16 months of age (corrected chronological age—56 weeks), confirmed the favorable prognosis. Sensitiveness to light apparently was lost. Irides previously slaty blue, now a dirty brown. Behavior near 56 weeks level. She stood momentarily alone; withdrew a cube from a cup; released a ball in to and fro play; cast objects; comprehended several words; vocalized with incipient jargon. Showed spirited drive, emotional reactiveness combined with control, and a perceptive parent-child rapport. Outlook excellent if adequate socializing ex-

perience can be provided throughout the next five years. Medically this case demonstrates that a combination of extreme prematurity, blindness, and neonatal complications does not necessarily produce serious retardation.

CASE 2 referred for observation at the age of 48 weeks because of extreme blindness. Examination revealed pigmentary degeneration of the retina and bilateral optic atrophy. Electroencephalogram showed absence of occipital alpha waves as the only abnormality in the record. The developmental examination indicated retardation within the 28 weeks zone of maturity. Muscle tone was good. There was fair drive and no evidence of gross deterioration. Optimal behaviors included: in prone position, props self on forearms, gets up on knees and elbows, rolls over to supine, grasps cube with radial palm, transfers cube, vocalizes "da." The context of these behaviors was relatively good but the behavior picture was not sufficiently decisive to warrant a favorable prognosis. Reexamined at 18 months the child still presented an attractive appearance ("large beautiful eyes"). Blindisms, however, were more marked. She dug her fists vigorously into her eye sockets. Postural control was seriously retarded. She sat alone only briefly. She groped undiscriminatingly for a toy. Her vocabulary was limited to one word. The behavior was fragmentary and poorly integrated. The pneumoencephalogram indicated cortical atrophy. The behavior picture at the age of 2 years tended to confirm the pneumoencephalogram. Exploitation of test objects was sketchy and infantile, consisting of mouthing, transfer, blowing, and tapping. Despite slight gains in vocalizations and vocabulary, the maturity ratings nowhere rose above the 12 months level. The final examination at the age of 30 months showed minimal progress in the interval. Behavior continued to be infantile and increasingly stereotyped. Two more words had been added to her meager vocabulary. Developmental outlook now so poor as to justify recommendation of institutional care. The blindness is of unknown etiology. The developmental career suggests that the degenerative process was not limited to the optic nerve and eventuated in amentia of low grade.

CASE 3, age 18 months, micro-ophthalmic with fibroplastic membrane, almost totally blind: but laughs with pleasure when flashlight is turned in eyes. No perceptible reaction to darkness; but follows flashlight with rotary head movements and directs walking steps toward light, when supported by two hands. Does not walk unaided. Child is active rather than inert. Indulges in musical vocalizations, postural rocking, head rolling, playful head banging, and in bilateral kneading of the orbits. Pat-a-cakes,

vocalizes "da da," cruises around crib. Prognosis doubtful because total behavior picture shows poor organization as well as retardation. She does not feed herself and activity is highly stereotyped. However, a few behaviors like "casts objects," and "toilet partially regulated," are near normal expectation; and child should be reexamined periodically to determine whether favorable reorganization trends will become manifest in the next two years. If so, the prognosis will improve. If not, a diagnosis of amentia may be established, and this is a more likely outcome.

CASE 4. This boy now over 2 years of age was born with complete bilateral anophthalmia, a very rare congenital anomaly, particularly striking in this instance because in all other respects he has proved to be remarkably normal. Birth, neonatal, and health history uneventful. Heredity negative. No complications during pregnancy; although the possibility of an unrecognized virus infection cannot be excluded. Physically this child makes an agreeable impression, enhanced by magnetic personality traits. Cranium and facial features are well formed, but the eye sockets are sunken, the eyelids are diminutive and closed, the eye lashes scanty. Puncta and lachrymal glands function. Palpation of the orbits indicates an underlying soft, amorphous mass. X ray indicates that the optic foramen is closed and the optic nerve is presumably wanting. EEG (at 40 weeks) was normal for age.

Systematic developmental examinations at 16, 28, and 40 weeks and 12, 18, and 24 months have shown consistently normal behavior development throughout this period. At the age of 16 weeks, he held the rattle actively, brought it to the mouth; engaged in mutual fingering in spontaneous play; maintained good head station in the seated position, scratched the table top; vocalized with squealing and well defined laughter; heeded the examiner's voice, and interrupted activity to listen to sound. Head rotation was restricted, and the head tended to plunge with exaggerated abruptness. This atypical behavior and the impassiveness of countenance, were attributable to the visual defect; but the drive was vigorous and the behavior patterns in form and in context approximated to an amazing degree those of a seeing child of similar age. A favorable prognosis was made on the basis of drive, emotional characteristics, and the integrity of the total behavior picture. '

Similar approximations to normality were demonstrated in the subsequent examinations. At 28 weeks he banged and transferred a cube; at 40 weeks he plucked a pellet pincerwise; at 12 months he cruised from chair to chair, and released a ball with a slight cast; at 18 months he walked well and combined two words responsively; at 24 months he had a vocabulary of 30 words, and spontaneously combined 3 words. He

adaptively inserted a rod into the performance box. At 27 months he participated in nursery school play and made excellent personal-social adjustments. Although the culture makes increasing demands on discriminative vision, much of his behavior under adequate safeguards was essentially normal in basic pattern and purpose. For example, while trying to climb into a chair he exclaimed, "I can do it!"

This case is highly significant from the standpoint of developmental diagnosis. It represents a test tube demonstration of the fundamental role of maturation in the patterning of human behavior. Our culture is highly dependent on visual cues. Most of our daily activities are guided and even initiated by visual signs. The culture cannot, through its seeing agents, impart these signs to a blind child. He is deprived of all ordinary opportunities of imitation. Nevertheless, he conforms to an impressive extent to the culture, because through intrinsic growth processes he is able to bring forth formed and forming patterns of behavior which proceed into desirable channels. But this does not happen when the normal growth potentialities are wanting or destroyed or damaged. Too often the complications of deafness and blindness are not neatly limited to the sensory functions; other structures and functions are affected and the growth potentialities are thereby reduced; the child proves to be seriously retarded. Often the retardation is mistakenly ascribed to the sensory defect alone.

But in the present instance, Nature performed an unwonted experiment for our instruction. In the embryonic period, she neatly limited a lesion to the receptor organs of vision; and left all the rest intact.

The gravity of any handicap depends primarily on the maturational reserves. In directing and planning guidance programs for the handicapped infant, more attention should be given to the maturational factors, and less to habit training. Our effort should be to entice and to release the natural reserves. The blind infant should not be permitted to lie on his back for months. Perhaps, as early as 16 weeks he is ready to respond to propped up sitting. The test should at least be made to determine his potentialities: and taking the cue from his maturity symptoms, he should be encouraged to grope, to reach, to grasp, to manipulate, to stand, to walk, to run,

and to play games in so far as his development permits. Interpretive developmental diagnosis thus leads to developmental guidance.

§ 4. The Later Career of the Blind and the Deaf

The fate of the infant suffering from sensory defect depends largely upon associated factors. For this reason the more precise the early diagnosis the more implications it has for prognosis. The vocational outlook of the handicapped must necessarily enter into the physician's judgment and advices.

First and foremost it is essential to achieve a differential diagnosis between sensory defect with amentia (or amentia with sensory defect) and sensory defect with potentialities of normal development. If this differentiation is not attempted there is danger of excessive preoccupation with the defect itself; and this leads to the same errors of misunderstanding and management which have been pointed out in connection with cases of pseudo-symptomatic retardation. Therapeutic tests including long periods of observation under educational programs, may be necessary to establish a final diagnosis. If amentia proves to be a complication, elaborate training measures directed toward the specific defect are of doubtful wisdom.

In the relatively normal child, personality factors will prove of ultimate importance, particularly with the deaf who are subject to emotional deviations which tend to separate them from hearing persons, and to segregate them with their own kind in adult years. Fortunately, however, the vocational outlook is good in numerous occupations which place chief reliance on vision as opposed to hearing. This includes many kinds of factory work, accountancy, draftsmanship, etc.

The adult blind present fewer problems in the way of social adjustment. Personality factors are less likely to complicate this adjustment. The native intelligence of the individual, supplemented by the protection of the seeing-eye dog, makes for relatively normal adjustments to community life. Detailed planning of life arrangements, as well as vocational placement, is important. Here, even more than with other forms of handicap, intelligent social work is of great value. The physician is often the first person to set the assistance of social and community agencies into motion.

CHAPTER XIV

DEAFNESS

Tactility is the oldest and the most fundamental of the senses. Hearing is a specialized form of touch which makes the organism aware of vibrations of distant origin. Like vision it is a distance sense which enables the individual to get into *touch* with what is spatially remote. To a profound degree the deaf child is "out of touch" with his surroundings. He suffers from lack of contact with what is happening all about him. These self-evident statements are made to remind us of the peculiar isolation which constricts the development of the deaf and the hard-of-hearing infant.

Deafness isolates him even from himself, for he does not fully sense the vibrations which he produces with his own larynx or through his manipulations of the physical world. There is no resonance in his inner life—no echo to reflect mirrored images of sound. He is wrapt in silences.

§ 1. The Role of Hearing in Normal Infant Development

The normal infant does not grow up in a world of silence. To appreciate the meaning of a hearing handicap it is necessary to trace the role of auditory experience in the early development of human behavior. Neurologically the mechanism for hearing is prepared well in advance. There is good evidence that the fetus responds with sudden movements to loud sounds. This reaction may be regarded as an auditory reflex, or as a tactual reflex if it is mediated by the skin of the fetus rather than the organ of Corti. Certain it is that premature infants with a fetal age of 30 weeks or more, in the absence of muffling fluid in the middle ear will react positively to the sound of a tinkled bell, either by positive movements or by immo-

bilization of movement. The full term neonate assumes nothing less than listening attitudes to the sound of the human voice, within the first fortnight after birth.

It is quite possible that ontogenetically the infant is at first most susceptible to the sound of a voice, particularly to the fundamental laryngeal tones with a vibration frequency of 100 to 400 per second, which is also the frequency of the vibrations of his own vocal cords. Later the normal infant becomes sensitive also to the overtones of the laryngeal sounds, whose frequency ranges from 400 to 2400 vibrations. These frequencies correspond to some of the consonants and to special vowel characteristics. The third band of frequencies (from 2400 to about 8000) includes the fricative sounds v, s, and z which are made by placing the tongue close to the teeth or the palate.

The normal infant undoubtedly passes through successive growth stages with respect to his sensitiveness to speech vibrations as he matures. Auditory discrimination like visual discrimination comes by gradual degrees. We are dealing with a complex mechanism of perception, not merely the simple capacity to hear. There are normal sequences in the development of auditory perceptiveness; but there are enormous individual differences in the time and completeness of their appearance. There are variable lags with respect to different vibration frequencies. Sometimes there is a kind of color blindness, —islands of tone deafness. Such lags and gaps are at the basis of retardations and deviations in speech development. Or there may be definite lesions or dystrophies in the auditory mechanism.

Impairment of the mechanics of the ear produces conduction-deafness. Neurological impairment of the eighth nerve and its end organs in the basilar membrane produces perception-deafness. Total deafness implies complete imperviousness to sound vibrations. High-frequency deafness operates as follows: (1) loss of discrimination in the upper range renders the child unable to perceive or to imitate consonants; (2) loss in the middle range annuls vowels, semivowels, and consonants; (3) loss in both ranges produces the equivalent of sensory aphasia, but is actually a defect in the function of hearing. The normal infant of adequate maturity handles all ranges of frequency, including the low fundamental range which is so important for the more or less instinctive modulations of tone which express moods, attitudes and shifting emphasis.

The mere enumeration of these purely sensory aspects of auditory function demonstrates how handicapping even partial forms of deafness must be for the sheer mechanics of behavior, including speech and the reception of speech. But this is only half of the developmental disadvantage. Normal hearing plays an extremely pervasive role in patterning of adaptive and personal-social behavior and in the organization of emotional life.

Vision is the intellectual sense. Hearing to a considerable degree is a social as well as intellectual sense. Sounds acquaint the infant with important aspects and events in the physical world. But through hearing he also establishes primary social contacts and acquires the cultural meaning of what occurs in the course of his everyday living. The human voice comes to mean the presence of his mother. It offers a reassurance of security scarcely less than the touch of her hands. It doubtless has more affective content than the mere sight of her face. The sound of approaching footsteps awakens anticipations and assurance. The clicking of the spoon in a bowl comes to mean food. At first the click originates with the adult who cares for him. Later the infant executes the click himself. This self-produced sound gives him a sense of power. It also adds to his insight into the constitution of the physical world. The whole web of the child's environment is permeated almost continuously with sounds: episodic sounds, routine sounds, occasional sounds, emergency sounds,— sounds of varying quality and intensity which enter into the very substance and patterning of the psychological environment. The deaf child is denied this substance and this patterning.

But his gravest deprivation is in the sphere of socialized communication. To be sure he retains one of his distance senses, namely, sight; and thereby he establishes contact with the persons who surround him. He begins to read their facial expressions. In time he interprets their gestures but he is blind to the modulations of the speaking voice which accompanies social interchange. It is almost instinctive for a mother to talk to an infant long before he understands articulate words. By such talking she conveys moods and emotional values which contribute to the organization of personal attitudes and of social patterns of behavior.

This is not a one-way social system. The infant has a capacity to

produce vocalizations himself. Even in the neonatal period he makes small throaty sounds in the fundamental register of tonal speech. By the middle of the first year he is making polysyllabic vowel sounds and beginning to penetrate the higher band of vibration frequencies by articulating consonants which begin with m and with d. In the third quarter of the first year he is beginning to put these powers to socialized uses. During the second year he imitates, often with musical fidelity, the auditory syntax of speech, exercising in variegated jargon the phonetic framework of conversation.

The second and third years are extremely rich in auditory experience. The child organizes this experience by functioning both as a receiver and as a producer of sounds. Hearing is not a passive capacity. Human ears may not prick; but there are numerous other neuro-motor sets. Just as visual fixation and pursuit have a patterned motor expression, so has auditory experience a motorized component. At 18 months he swings rhythmically with his whole body in response to music. He spontaneously hums and sings syllables with wide ranges in tone, pitch, and intensity of voice. At 3 years his rhythmic responses are less comprehensive but not less discriminating. He bends at the knees, he sways, nods the head, or taps the foot to keep time. He sings as he rocks in a chair. He recognizes a melody. He sings phrases of songs. He may reproduce the entire song. He begins to match simple tones. He enjoys group participation in rhythmic play. He gallops, jumps, walks, and runs, keeping good time to music.

By all these diversified activities he strengthens his auditory rapport with his socialized environment and with important cultural forces in that environment. Only gradually does he master the higher ranges of vibration frequency. Even at 3 years he is not able to imitate the frequencies involved in difficult consonants. It is, therefore, quite normal for him to continue with infantile malarticulation almost up to the age of 5 years. Speech is a complicated technique and emerges in an extremely intricate social context. The deaf child, as we shall presently see, is pitifully disadvantaged in his mastery both of the technique and of the social context.

§ 2. The Early Symptoms of Deafness

With the foregoing outline of the normal course of auditory development in mind, we are in a better position to understand the

origin and nature of the behavior symptoms which are distinctive of deafness. In the first few weeks after birth the psychological growth of the deaf infant is not much affected; but in a few months he begins to show a developmental deficit. He may smile, he may laugh, he may vocalize; but his vocalizations are reduced in range and amount. Even his laughter may diminish; but it suffers less at first because it is less dependent upon auditory stimuli and indeed upon social stimuli. If his smile grows fainter it is because of secondary emotional consequences. His vocalizations tend to become brief and monotonal. He does not indulge in those long stretches of experimental sound play in which the intact infant delights, not only out of sheer euphoria but out of interest in the sounds produced. In this sound play the infant in time talks to himself, just as he looks at himself in mirror play. He does not merely indulge in sound production; he practices sound perception. As he matures he actually shifts the focus of attention from squealing to the squeal itself. He modulates his vocalization to perceive the effect of the modulation.

The deaf infant cannot indulge in such profitable soliloquy. He becomes more mute with time. Since he has no echo equipment for duplicating his own sounds he has no means of imitating those of others. Nor does he have the social motive for improvising sounds, which is the very device which the normal infant uses to establish lines of communication. Absence of spontaneous sound improvisation is, therefore, an early symptom of deafness.

Reduced social rapport and diminished vocal intercommunication, likewise, are premonitory signs of subnormal hearing in infancy. Increased visual alertness and responsiveness to facial and pantomimic gesture compensate for the auditory lack, and sometimes mask it, particularly in an expressive reactive child. Extraordinary visual attentiveness is in itself a suggestive symptom. Multiplying signs of social remoteness may also be detected.

The symptoms of deafness vary of course, not only with the gravity of the sensory defect but with the temperament and treatment of the child who carries the handicap. But retardational effects begin to register symptomatically even in the field of adaptive behavior, prior to his first birthday. The deaf infant sees the passing show of life as a silent cinema, discontinuous, devoid of sound effects and of spoken script. The lack of sound accompaniments attenuates the reality of things; there is less meaning in a clock which does not tick,

a spoon that does not click, a ball that bounces without a thud, a laugh that is inaudible. Hearing was intended to make the remote near. Deafness tends instead to push the child into remoteness. It therefore has a subtly retarding effect on practical as well as social intelligence even before the usual period for articulate speech.

The failure of language development accentuates retardation. There is a disproportionate reliance on concrete gesture. Words as signals and as symbols are not in his ken. Toward the close of the first year the normal child, on the other hand, has begun to listen to and readjust discriminatingly to words. The hearing infant learns to inhibit an action on a verbal cue. Moreover he uses vocal signs and words in situations highly charged with social values. He continues to use gestures, even total-response gestures; but words comprehended and words spoken are already beginning to function as labels for simple generalizations and as expressions for personal mental states. Eighteen months is the transition age when words are used to express ideas, and are adopted as substitutes for gestures. The well known declaration, "All gone!" which voices the idea of termination and of disappearance is utterly beyond the scope of deaf mentation at this tender age. (Not until about the age of 3 years does a deaf child shrug his shoulders and hold up his hands in an "all gone" gesture to signify absence or disappearance.) By the end of 2 years the normal child asks for food, toilet, and drink; verbalizes immediate experiences and poses questions such as "What's dat?" At 3 years he asks rhetorical questions, expresses desires, refusals and denials. He even formulates requests for help.

It is in this transition period between 1 and 3 years when primitive gestures give way to words that the deaf child is peculiarly beset. He has not lost something that he once had; he is perpetually foiled in getting something which he ought to have, something which is almost indispensible for the very process of development. When, as so often happens, parents (and physician) fail to recognize the deafness, confusion becomes confounded; tensions are set up; ill-conceived discipline and training are resorted to; strange rebellions and obstinacies are provoked. This infant-toddler period therefore breeds characteristic symptoms, some of which are due to the defect in the mechanics of development; others are due to faulty management. The negative and "rebellious" symptoms are easily mis-

interpreted. A deaf child may stamp his feet for three reasons psychologically quite different from each other: he may be vexed with others that they do not understand him; he may be vexed with himself for his failure to make himself understood; he may simply wish to call someone to him.

Deafness threatens the personality more than it does the intellect of the child. The threat is due to the weakening of lines of communication. When social intercourse is thwarted symptomatic behavior problems arise. Frustrations lead to tantrums, yelling, and head banging. Incidentally the banging may yield some satisfactions in arousing vaguely felt conductive vibrations. Irritability is a common symptom. An incident will illustrate. A deaf boy is engrossed in play at nursery school. When it is time to go outdoors the teacher brings in his coat. He looks up and suddenly begins to stamp his feet and screams a loud monotonous shriek in vigorous protest. The teacher is taken aback, for the child is intelligent and usually obedient. He has missed his cue; it is not time to go home. When he is shown the play yard he understands at once and the shriek terminates abruptly.

This trivial incident properly falls under the heading of symptomatology because this kind of behavior is typical of the way in which a deaf preschool child reacts to the ever present barriers of noncommunication. The reaction is exacerbated if the parents insist upon some uncomprehended verbal form of communication at the expense of the comprehended gesture. The only way in which the barriers can be lowered is to foster gesture and dramatization at every opportunity, until the foundations for communication are firmly laid.

If deaf children seem stubborn and unreasonable it is because they have ideas of their own. They must have more of their own than of any other kind, when insufficient pains are taken to communicate to them the ideas of others. (The mother who said impatiently, "He is too lazy to talk," was unreasonable too.) If deaf children seem suspicious it is not so much because of fearsomeness as because of an uncomprehending alertness as to what *might* happen. When they know what is going to happen they become acquiescent and even good-naturedly co-operative. This is well illustrated in the conduct of a boy who at the age of 2½ years was referred

as a behavior problem, with irritability and tantrums as the chief complaint. The parents had fallen into the habit of managing him forcibly when he seemed resistant. They removed his coat by tugging, over his protest; they dragged him upstairs when he refused to walk. During the examination he seemed very intent on carrying out his own ideas, rather than heeding the examiner's directions. He worked with concentration when interested; but became resistant when transitions had to be made. He found that he could make a fine noise by stamping on the experimental staircase. He proved to be seriously deaf. His parents, not recognizing the condition, had resorted to severe disciplinary methods which only aggravated the tantrums and rebelliousness. He was regarded as a behavior problem. The behavior *symptoms* were taken to be the problem. *Deafness* was the real problem.

This account of the genesis of symptoms in the young deaf child suggests the possibility of early diagnosis on the basis of behavior. A critical study of behavior symptomatology by means of a developmental examination and interview will reveal cases which would otherwise remain concealed and misunderstood.

§ 3. The Diagnosis and Management of Infant Deafness

Deafness in young children may be either congenital or acquired. Secondary, or acquired deafness in a child originally endowed with normal hearing is a not infrequent sequel of meningitis; cerebral injuries account for a few more cases. In recent years another cause of deafness has been recognized—imperfect development of the auditory apparatus consequent upon rubella in the mother during the first trimester of pregnancy. This disease almost invariably produces maldevelopment in the offspring: the eyes alone may be affected, or only the ears, or the visual or hearing defect may be associated with amentia. The condition may be considered "congenital" in the sense that the child is born with the defect, but is more properly considered acquired since the abnormality is not carried in the genes. True congenital deafness is more or less familial and often several children in one family are affected. Otitis media rarely causes a serious enough hearing loss to interfere with the early acquisition of speech and language communication.

A large proportion of deafness which is said to originate after

three years of age, is doubtless present earlier but not recognized. In an impressive number of instances parents, teachers, nurses and physicians fail to detect deafness, when the later history of the child's development clearly shows that deafness was his sole and primary handicap from the start. Even after children have attained school age their failure in school is attributed to dullness, and their misbehavior at home to perversity, when the underlying cause is simply defective hearing. It is amazing that so many cases go undiscovered.

Diagnosis in early infancy is indeed difficult, because there are no practical objective methods of measuring auditory acuity in infancy, and because the infant apparently gets along so well without hearing. Vision has the lead in early development and furnishes the infant with most of his directional cues for the conquest of his physical environment. Moreover, we do not know for a certainty whether he is naturally supposed to have full command of the total range of vibration frequencies in the early months. A sensitiveness to sound would not necessarily rule out potential perception deafness for the human voice. The method of the conditioned reflex has been ingeniously used by Aldrich to determine the presence of hearing. At intervals of a half hour during the night and part of the following morning the infant's foot was scratched simultaneously with the ringing of a bell. After this association was established, that is at midmorning, the infant retracted the foot or cried on the mere ringing of the bell. Some method equally effective for the frequency range of the human voice will probably be evolved when more is known concerning the developmental psychology of infant hearing. It will be particularly important to devise a method which will measure the sensitivity to different bands of vibration frequency. Many of the cases which elude early diagnosis are selectively deaf because they selectively hear only parts of sound patterns. Speech for them is like the mumbling of a defective radio set. They live not in a world of silence but of smudged sounds. This is the reason they cannot understand their teacher; this is why they do not always obey their parents.

No child has ever stepped up and said, "I am deaf," or "My hearing is blurred." A child so handicapped assumes it is part of the order of the universe. Much less does a deaf infant make any subjective report of his condition.

SIGNS SUGGESTIVE OF DEAFNESS IN INFANTS AND
YOUNG CHILDREN

I. *Hearing and Comprehension of Speech*

> General indifference to sound
> Lack of response to spoken word
> Response to noises as opposed to voice

II. *Vocalizations and Sound Production*

> Monotonal quality
> Indistinct
> Lessened laughter
> Meager experimental sound play and squealing
> Vocal play for vibratory sensation
> Head banging, foot stamping for vibratory sensation
> Yelling, screeching to express pleasure, annoyance or need

III. *Visual Attention and Reciprocal Comprehension*

> Augmented visual vigilance and attentiveness
> Alertness to gesture and movement
> Marked imitativeness in play
> Vehemence of gestures

IV. *Social Rapport and Adaptations*

> Subnormal rapport in vocal nursery games
> Intensified preoccupation with things rather than persons
> Inquiring, sometimes confused or thwarted facial expression
> Puzzled and unhappy episodes in social situations
> Suspicious alertness, alternating with co-operation
> Markedly reactive to praise and affection

V. *Emotional Behavior*

> Tantrums to call attention to self or need
> Tensions, tantrums, resistances due to lack of comprehension
> Frequent obstinacies, teasing tendencies
> Irritability at not making self understood
> Explosions due to self-vexation
> Impulsive and avalanche initiatives

For this reason *diagnosis must fall back on that most comprehensive and integrated indicator of the child's well-being, his behavior.* Deafness can be suspected, inferred, and finally established on the basis of behavior symptoms such as we have already outlined. The various symptoms and clues which may be used to derive a diagnosis of deafness are herewith listed in the accompanying table. These diagnostic signs are subdivided into five developmentally related categories, the separate items arranged in an approximate genetic order.

The separate items are not of equal importance and they do not all appear in a single individual. Some are characteristic of the first year, others of the second and third years. No item should be ignored if there is the least suspicion of perception-deafness, partial or complete. If there is a recurring suspicion of deafness there probably is deafness. When a mother brings her child to the doctor and hesitatingly suggests that she isn't quite sure that the child hears, we begin to suspect that he does not hear.

But first we must rule out feeblemindedness. There are certain types of amentia characterized by a peculiar heedlessness to sounds. This may be due to an aplasia of the cortical structures which determine auditory attention and auditory imagery. Or it may be due to a somewhat specific retardation; for the same ament who was so heedless to sounds at one age may prove to be perceptive when returned for re-examination at a later age. And, of course, a child may be both deaf and feebleminded. Differential diagnosis on this point becomes important after the child reaches the age of 3 or 4 years and placement in a school for the deaf must be considered.

When amentia has been ruled out, the chief alternative diagnosis is a personality disorder of some kind. This diagnosis is oftentimes seized upon to account for the observed peculiarities of conduct. "Emotional blocking" is a favorite explanation when there is residual or selective frequency hearing and when strife has arisen between parent and child, because of imputed wilfulness, etc. The child hears some sounds; therefore he cannot be deaf; therefore a psychopathic suppression or negativism causes the child to be indifferent and rebellious—so the argument runs. This kind of interpretation leads to errors of diagnosis and management, similar to those which have been described for pseudo-symptomatic retardation. The child proves

to be suffering from a primary perception deafness. Most of the syndrome is explainable on that basis and needs no recondite rationalization.

Fragmentary and mumbled hearing and even snatches of articulate speech are not inconsistent with a diagnosis of deafness. To manage a child so handicapped as though he could hear (or ought to hear!) leads to grave mistakes. It is wiser to resolve the diagnostic doubt by treating the child as though he were deaf; and to watch the results as a therapeutic test. This is a pretty safe rule, which would prevent wildgoose delays of diagnosis: When a child acts as though he were deaf to the human voice, *treat him as though he were deaf.*

The fact that such a child may hear the slam of a door, that he runs to the window to see a truck, that he has heard an aeroplane overhead, does not contraindicate a diagnosis of perception-deafness. It is the lack of responsiveness to the spoken word which constitutes his handicap; and the essence of that handicap is obstruction of communication.

The cardinal objective in the management of the deaf child is the conservation of all possible communication. The most fundamental objective is *not* speech; although speech becomes in time a most important means toward realizing the cardinal end. *Socialization* to preserve the optimal growth of personality is the practical problem.

Audiometric studies show that the majority of young deaf children have usable amounts of residual hearing for some pitches and frequencies. The modern trend in training children over 4 years of age is to build on this residuum, to rely less exclusively on sight and touch methods. With the aid of amplifiers and sound-producing toys the deaf child is taught to distinguish between gross sounds of different frequencies, to give quick and accurate response to sound, to listen to the amplified and unamplified voice, to discriminate between high and low pitch, to co-ordinate lip reading with hearing, and to make a maximum use of his residual hearing in the acquisition of speech. These methods which may be initiated in the kindergarten years emphasize the foundational importance of basic socialization, the invigorization of the attitudes and motives of communication.

Ideally the diagnosis of congenital deafness should be made about

the age of 6 months, when the infant by many subtle tokens of re-
duced vocalization and subnormal auditory-social rapport reveals
his sensory defect. To compensate for his defect he watches vigi-
lantly, but his caretakers alone can fill the void of incompleted
interpersonal relations. Through gestures and dramatized intimacies
contacts can be built up, and the receding remoteness of the child
can be partly forestalled. There should be an unremitting premium
on *intercommunication,* not a premature emphasis on the spoken
word. If a fetish is made of oral speech, the gap between the child
and his personal environment may actually be widened rather than
narrowed. This is paying too much for the whistle! Socialization is
the first objective at any cost.

If there is residual hearing, there may be good reasons for having
playful periods in which the mother talks into the ear, holding her
lips but an inch away. This is done in the hope of storing up auditory
impressions which will some day aid the mastery of speech by oral
methods. But such approaches should be secondary to socialization,
and most of this fundamental socialization should come by the solid
and ancient route of gesture and pantomimic symbolization. Such
socialization comes first in the personality development of the nor-
mal child. It comes first and last in the life of the deaf child, if we
place the primary stress on the protection of his emotional welfare.
It is a significant developmental fact that deaf children naturally
watch the expression of the whole face rather than the mouth for
their cues. Lip reading comes later. Formal instruction in lip reading
may well wait until the age of 4 years.

Early diagnosis favors wise management. When deafness is diag-
nosed in infancy the parents will most readily understand that social
communicativeness is the supreme goal. This will tend to relax ten-
sions and to prevent the conflicts between adult and child which too
often impede the early progress of the deaf. If nothing is sacrificed
to socialization, real preventive work will have been done. The child
will be fortified in his natural desire to understand and to defer to
cultural demands. His trust in life will be strengthened as he becomes
more closely identified with the social group. And that is the cardinal
need in the mental health of the deaf child.

The mental health of the parents also needs consideration. It is

easy enough to say, in effect, "Your child is deaf. While he is little try to get into communication with him. When he is older he will need special education in a school for the deaf," but it is not easy for the parents to accept. They cling to the hope that hearing can be restored by medical or magical means; they plead for a fenestration operation, having read a popular article on the treatment of otosclerosis in adults; spines are "adjusted," hearing aids purchased without discrimination, airplane rides suggested, and invariably the adenoids are removed, usually with little or no effect on the hearing. The parent resists the idea of deaf school, is horrorstruck at the idea that his child may learn to talk on his fingers and thus advertise himself as a deaf-mute. The laity entertains an exaggerated idea of the facility of the deaf in lip-reading and in speaking, with training. Popular fiction does nothing to dispel these ideas and we read of the totally deaf spy who could lip read in seven different languages across a restaurant room full of people. It is, of course, all fiction but to the parents of a deaf child, it spells hope that their child can pass as a hearing person. Slightly more realistic parents will concede the need for a hearing device, but surely then there will be no handicap! The truth is in the majority of cases there will always be a handicap. The aim of the well adjusted parent should be to help his child become a competent, contented deaf person, able to communicate with others easily, rather than a poor imitation of a hearing person, laboring always to conceal his handicap.

§ 4. ILLUSTRATIVE CASES

Complete Congenital Deafness

CASE 1 had a second cousin who was born deaf, and a normal older sibling. She herself had never responded to any sound, not even a loud clap of thunder. She has had four developmental examinations:

At 16 months—general maturity level 12-15 months
At 21 months—general maturity level 18-21 months
At 28 months—general maturity level 30+ months
At 40 months—general maturity level 42 months.

Early, she showed a mild symptomatic retardation, which was gradually overcome and her developmental rate is now above average. Although totally deaf, she experienced very little difficulty in establishing lines

of communication with her family. As early as 16 months she was beginning to point to what she wanted and to respond to simple gestures. By 40 months she indicated with beautifully executed and understandable pantomime that she no longer used a baby's crib, but was a big girl and slept in a big bed. She did have considerable emotional difficulty due to her deafness, expressed first in tantrums when she did not understand or could not be understood, later in great anxiety and suspiciousness about new situations, when they could not be explained to her. Much of this was due to the parents' early maladjustments which resulted in submitting the child to many medical examinations and procedures, including adenoidectomy. Speech training was begun against advice during this suspicious phase at $3\frac{1}{2}$ years and her reaction to it is summed up in her vocabulary at the end of six months: "bye" and "home."

She is now in a special school for the deaf, making excellent academic progress, good progress in lip reading, and slow progress in speech production.

Familial Deafness

CASE 2 is of interest because of the family history and situation. The father is deaf, one of 12 children of whom 3 are deaf. He has "no voice" and never learned to speak though he attended an excellent school for the deaf for years. He is employed and supports his family. The mother also is deaf; she is one of 5 children, 2 of whom are deaf. She lip-reads and speaks, but uses a familiar person to interpret her speech to strangers and strangers' speech to her. The examiner can, however, get single words of the mother's speech, which is limited to 1-3 word sentences and is generously larded with gestures and nods. The parents believed their boy could hear but did not speak because he could not learn speech from deaf parents.

At 30 months he is reported to be very noisy, sometimes hears a loud voice or bell, but understands nothing said to him and has no words. He has had nursery school experience with hearing children but proved difficult to manage, fought, grabbed, became angry, and was very fearful of strangers. In the examination he was anxious to please, looked eagerly for cues, approval, and permission. General maturity level 24-27 months. Diagnosis: Familial Deafness in a dull to low average trainable boy.

Unsuspected Deafness, Following Meningococcic Meningitis

CASE 3 was a normal baby who had meningococcic meningitis at 6 months of age, with a supposedly complete recovery. A note by the re-

ferring physician *at 33 months* reads "Does not talk. Points, hears and obeys commands. Impression: Environmental Factors." The mother is inept and impatient. The child is violently noisy and assertive, antagonistic to the examination at first, suspicious throughout. She hears the bell but not voice and she ignores all purely verbal situations. Her general maturity level was 30-36 months. Diagnosis: Postmeningitic Deafness in a low average to average, trainable girl.

The mother had no suspicion that her child could not hear. She accepted the new diagnosis immediately as though a light dawned and made everything about the child comprehensible to her. She even expressed remorse at her previous lack of patience and understanding.

Deafness from Maternal Rubella (Family Maladjustment)

CASE 4. The mother had rubella in the third month of pregnancy. The birth and early development were normal but the boy was a feeding problem, the parents emotional. *At 33 months*, in requesting examination of their boy the parents write: "At 18 months used an occasional word but never seemed to speak. Still does not talk and has forgotten the few words he knew. A poor eater. His hearing is apparently normal." He was an attractive boy, alert to visual cues, and sailed through the examination at the 30 months level wherever he could get his cues by eye. Turned away from verbal situations. He heard his father's voice (father concealed), listened, looked puzzled and shrugged his shoulders. He did not recognize it or locate it as a normal child does.

At 42 months he watches lips for cues and reproduces some sounds, obediently but without meaning. General maturity level full 42 months. The parents are forever testing his hearing, the mother hectors him, the father bellows heavy commands at him. They feel the stigma of his hearing deficit very keenly and are evading realities. The boy is deaf due to maternal rubella; he is normally intelligent and certainly educable. The problem is the family adjustment and the effect it will have on this handicapped boy.

A Deaf Ament

CASE 5 had a paternal uncle who was mentally defective. She made slow developmental progress in infancy; did not display visual attention until she was 8 months old, and it was then noted that she did not seem to hear.

At 47 weeks—General maturity level 32 weeks. Vocalizations meager, no response to sound.

At 15 months—Hears loud noises and the radio. General maturity level 40 weeks with atypical patterns.

At 32 months—General maturity level a defective 18 months. The parents accept a diagnosis of amentia with deafness. They had never been satisfied that deafness alone could account for her slow development although they had received a good deal of assurance from various physicians that this was the case.

At 5 years—General maturity level 3 years. Head banging, tantrums. Had been refused admission to school for the deaf. The basic problem is amentia and she is not considered a suitable subject for special training.

§ 5. INFANTILE APHASIA

We use the term *Infantile Aphasia* to designate a group of related symptoms in young children which are associated with language difficulties aside from hearing defects, speech defects in the ordinary sense, and simple retardation in the acquisition of speech. These language difficulties have to do with comprehension of meaning of the heard word, verbal associations, the ability to call up the proper words and language forms to express meaning, and the ability to manipulate language easily. We are still engaged in studying these interesting children but even in the present incomplete state of our knowledge, they merit description.

Aphasic symptoms are found in a number of conditions; in association with cerebral injury, with defective hearing, with personality deviations of greater or lesser degree, and also with some atypical forms of amentia. The symptoms vary a good deal in severity and form, and tend to diminish with increasing maturity.

In the milder forms, parents complain with an uncertain and apologetic air that the child's words are never his own; he can say what has been said to him but he cannot formulate his own sentences. He does not know how to ask a question, but always uses a declaratory statement form even when he obviously means to ask a question. Or he does not know how to answer a question, but can only repeat it. Or, again, he may not comprehend what an answer is, but repeats his question over and over, with increasing insistence and concern, until his question is repeated instead of answered; then and only then is he satisfied. He may experience an inordinate difficulty in achieving the transposition of *you* and *I*, calling himself 'you' and his mother 'I' for months on end. He may be able to make

spontaneous remarks of good content and quality but comes up against an impasse if his remark must be responsive.

The normal child stumbles a little over these language mechanisms in the course of his development, but he stumbles so slightly and for such a brief period that parents hardly notice the error. The child we are describing is from 3½ to 5 or more years old; he can easily give such rote information as his name, address, and sex, can count and recite nursery rhymes. He can, in other words, return any answer that he has in stock as a pat answer. But he cannot cope with the simplest question when he must devise his own reply. Parents are at first irritated by the monotony and repetitiousness of the child's conversation; they finally become alarmed at the child's apparent stupidity.

In these mild cases the eventual outlook for normal or relatively normal manipulation of language appears to be good. The difficulty has to do with integrating and coordinating mechanisms, but it apparently does not inevitably preclude eventual integration and coordination. The conversational deficits finally resolve in many if not most instances. We have not yet followed enough children of this type into school age to make a general statement about reading facility and school achievement.

At the other end of the scale are the severer language disabilities, which may, in some cases, even simulate deafness. They simulate deafness because the spoken word though heard, simply has no meaning whatsoever to the child. Hearing can be assumed to be present and adequate if the child can reproduce the spoken word; meaning is absent if he cannot react appropriately to the word. Some children cannot even reproduce the word, in which case the differential diagnosis from deafness becomes extremely difficult. But it should be stated that the deaf child of normal intelligence, once communication lines have been established, has no difficulty with simple, concrete ideas and concepts; he "catches on." The seriously aphasic child learns language only after almost endless drill, and his learned responses are almost completely stereotyped. He cannot play with words, paraphrase, or ring the changes. Language is a stiff and clumsy instrument which he wields only with the greatest difficulty.

The outlook for normal use of language is less promising in the

seriously aphasic child. The speech he acquires does not have the tonal lacks of the deaf child, but speech is so limited as to make him almost inarticulate. Drill and training with endless patience are the only available forms of treatment; many of these children actually make their best progress in a special school for the deaf.

It is important to recognize the nature of these language difficulties, important to establish the correct diagnosis and to make the right interpretation. The question of amentia always looms very large; if the child is an ament, the basic problem is the general retardation. If amentia can be safely excluded, the language problem is to be faced in terms of a true organic deficit.

Illustrative Language Patterns

The following conversations are verbatim records of language interchange between examiner and child during the course of a developmental examination. It should be stated that in no instance is the failure to respond correctly due to a withholding of response by the child; and all the questions asked are fair questions, easily answered by the normal child of comparable age.

CHILD A

EXAMINER	CHILD, 3½ YEARS (HOSPITALIZED)	
	⌠"I want my cup."	Spontaneous
	⟨ "I want my blanket on me."	remarks to
	⌡ "Put it on my bed."	the nurse.
(Shows picture book).		
"Do you want to play?"	"Yeh." Smiles.	
"What's that?"	(Confidently) "That's a——that's a——."	
"What's the girl doing?"	"She's doin'——she's doin'——."	
"What's that?" (dog)	"That's a——that's a——that's a——."	
"What does he say?"	"He says——."	
"He says bow-wow."	"Yeh!"	
"What does this girl have?"	"She's got a——a——a——."	
"It's a spoon."	"Yeh!"	
"What happened to her dinner?"	"It spilled."	
"What's this?" (dog again)	"It's a——a——a——I don't know maybe."	
"What's your name?"	"John Doe."	
"Say 8537."	"8537."	

Note that this child can verbalize his wants without difficulty. Speech is clear; he is alert, interested, and eager to play. He cannot name an object but seems to recognize the name when it is supplied to him. Each time a question is put to him, he seems confident of his ability to answer, surprised when the word is not forthcoming. He repeats digits with ease; and the old learned response to the

question of his name, rolls out without hesitation. His adaptive be-
havior is normal for his age and he is not retarded; he is, however,
aphasic.

The condition for which he is hospitalized (osteogenesis imper-
fecta with fracture) does not yield any ready explanation for the
aphasia.

CHILD B

EXAMINER	CHILD, 3½ YEARS
(Showing picture card and pointing)...............	"A dog, a house, shoe——clock."
(Showing Binet Picture Card) "What do you see?" ..	"What do you see?"
"What do *you* see?".............	"What do *you* see?"
"What *do* you see?"....	"What *do* you see?"
"What do you *see*?".......	"——You see——girl."
"What else?"...........	"What else?"
"What else?".............................	"What else?"
"What else?" (insistently)......................	"What else—a house."
"What else?".....................	"What else?" etc.
(No visual stimulus)	
"What runs?"...............	"What runs?"
"Does a doggie run?"	"Does a doggie run?"
"And a car?".......................	"And a car?"
"What sleeps?"...............	"What sleeps?"
"What scratches?".............	"Scratches?"
"What bites?".....................	"What bites?" etc.
"What's your name?"...........................	"Say your name is Johnnie Jones."
"Are you a little boy or a little girl?".......	"Little girl. 25 Third Street."

This boy is referred for study because of his language difficulties
and because of the question of serious general retardation. The
parents state, "He does not *use* speech, not to express his wants, not
to relate his experiences, nor in even the most rudimentary conver-
sation. He never answers questions. He understands speech and will
carry out requests. He never greets anyone or responds orally to a
greeting. He repeats sentences that he has heard, with dramatic
emphasis. The relevance of his speech varies from nil to complete.
He is completely unsocial." He is showing very deviant behavior,
particularly in the development of his social relationships and feel-
ings toward others. Adaptive behavior in the examination situation
is at age, but he ordinarily operates at a much lower level.

Note that he can name pictures spontaneously, but that he merely
repeats and repeats a question, varying his inflection to match the
examiner's. Occasionally, after much persistence, a pertinent response
is elicited. Like the previous boy, he can give his name. But note
the form of his reply; it is what someone else has said to him. He

gives his sex incorrectly because he is merely repeating the question, and then by rote he gives his address although it was not called for. His only spontaneous remarks were of a repetitive nature, obviously reproductions of questions and answers he had once heard. "Do you want to go home, Johnny? Not yet."

The aphasia in this child is only one aspect of a very complex clinical picture, requiring further study for full interpretation.

CHILD C

EXAMINER	CHILD, 6 YEARS
"Why do we have houses?"........ ..	"I don't know what you say, houses, because— I haven't a house."
"Why do we have books?"........ ..	"Cause, cause, cause I have a couple of books."
"What do we do with our eyes?".... .	"See the eyes."
"What do we do with our ears?"... .	"See the ears."
"What runs?"................	(Looks puzzled)
"Does a car run?"..........	"Yes."
"What cries?"....	"A baby cries."
"What scratches?".............. ..	"No, two."
"What sleeps?"....	"One two sleeps."
"What swims?"......	"Two swims."
"Can you swim?"....	Nods, "I pick my feet up."
"What burns?"..............	"Two five two burns, birds."
(examiner coughs)............. . ..	"I got a bad cold, too."
"Put the ball on the chair."..........	(Does so.)
"Put the ball *under* the chair."....	Looks about the room in perplexity then puts it on the chair.

This girl is a friendly co-operative child, anxious to please. Her hearing has been questioned over and over again because she apparently does not understand much of what is said to her; her mentality has been repeatedly questioned because her responses to questions and verbal instructions are hopelessly inadequate. Yet her hearing is normal by audiometric examination, and in non-language tests she responds well within the normal range for her age. She is receiving special instruction in the hope of helping her develop her faulty conceptual language powers.

This child's birth history may well be of etiological significance. She was born at term weighing 6 pounds 9 ounces, after a difficult 52 hour labor. Delivery was spontaneous, but it was a breech birth. The child was cyanotic, required resuscitation, and did not suck. Difficulty with swallowing and chewing persisted till she was over 4 years of age.

CHAPTER XV

PREMATURITY

Prematurity is a medical problem with far reaching implications for developmental diagnosis. Prematurity accounts for three-fourths of the deaths which occur during the first day of life and for about one-sixth of the still-born. Over one-half of all deaths which occur during the first two weeks after birth are attributable to prematurity.

Do the prematurely born infants who survive pay a developmental penalty for their survival? Uncomplicated prematurity exacts no penalty. Prematurity of birth, however, is often associated with malformations, asphyxia, birth trauma, intracranial hemorrhage. Such complications if not lethal may produce permanent defects and deviations. The developmental fate of the prematurely born infant is always an individual matter determined by the severity of the complications and by his primary growth potentialities.

§ 1. Spurious Retardation

Prematurity in itself displaces the time of birth, but it does not thereby dislocate the normal sequences of development when the sequences are reckoned from the fundamental base line of conception. The first task of developmental diagnosis is to ascertain as accurately as possible the gestation age of the infant at the time of birth, and to calculate a corrected chronological age by discounting the weeks of prematurity. Gestation age represents the length of time the fetus has been *in utero*. It can be estimated with the aid of various criteria: the date of last menstruation, birth weight, head girth, body length. The physical signs of prematurity may also be taken into account.

The various criteria do not always agree; no single one is reliable.

but when judiciously weighed, they serve to establish a birth age value. This value when *subtracted* from 40 weeks (the full gestation period) establishes the amount of prematurity. This amount must be subtracted from chronological or calendar age to derive true age. For example, if a premature infant has a chronological age (reckoned from birth) of 28 weeks and if the menstrual history and the birth measurements point to a prematurity of *8 weeks*, then the true age (corrected chronological age) is *28 weeks minus 8 weeks*; i.e., 20 weeks. For purposes of developmental diagnosis the infant in question is considered to be *20 weeks* old rather than 28 weeks old. Naturally in the case of the postmature infant the age discrepancy must be *added* to the chronological age to derive a corrected chronological age (true age). For the full term infant no age corrections are necessary.

The diagnostic importance of making age allowances is concretely shown in the case of a *24 weeks old* infant who was brought to the clinic for examination. He was a surviving twin; the pregnancy had been terminated 8 weeks before term because of maternal toxemia. The parents were somewhat concerned about the possible effects of the prematurity, the stormy neonatal course and the early retardation in physical development. From a birth weight of 3½ lbs. the infant had attained a weight of 14 pounds. He was vigorously reactive without, however, showing any desire to sit up.

He was examined in the supine position in the clinical crib, with findings as follows:

He lies with head in the midline and maintains this midposition for prolonged periods. He rotates the head freely and turns it fully from one side to the other. Only traces of the t-n-r are seen. His arms are symmetrically active; they are predominantly flexed and the hands usually fisted. His legs are externally rotated and acutely flexed at the knees and the hips. He rolls freely to the side. He is regardful of his surroundings. He brings his hands to the midline where they engage. He perceives a dangling ring when it is presented in the midline and gives it immediate and prolonged regard. While he inspects the ring he brings his hands together over his chest, but he does not prehend the ring. He repeatedly follows it with his eyes through an arc of 180°. He shifts his regard to the examiner's hand which holds the string. When the examiner places the dangling ring in his hand, the infant regards it and carries it to his mouth.

When pulled from the supine to the sitting position he tenses his shoulders and shows no head lag.

These patterns are unquestionably less mature than we ordinarily expect in an average 24-week-old infant. They are *less* mature than those of the 20 week level, but they are definitely *more* mature than those of a normative 12-week-old infant. They are in fact highly characteristic of the 16 week level.

But this infant was 24 weeks of age. A retardation of 8 weeks at a chronological age of 24 weeks would create a developmental ratio of $16:24 = 2:3$, a D.Q. of 65. Such a D.Q. ordinarily would indicate mental deficiency of high grade. In the present case, however, the corrected chronological age, allowing for 8 weeks of prematurity, was *16 weeks*, a developmental ratio of $16:16 = 1:1 =$ a D.Q. 100. The retardation was spurious. The parents were assured that the developmental outlook was favorable, and that the child had suffered no ill effects from his "bad start," and indeed that his behavior was entirely normal for his true age. The subsequent growth history of this child has justified the assurance. At the age of 6½ years he is maintaining a full average level of intelligence.

This case illustrates a general truth: prematurity in itself does not markedly alter the normal course of mental growth. It neither retards nor accelerates. The premature infant several weeks after birth may exhibit an apparent precocity in a few forms of behavior such as eye following; but his fundamental behavior maturity is not advanced and he gains no real advantage from his head start; nor does he suffer any setback.

His developmental status must always be appraised in terms of corrected age rather than postnatal age. Born or unborn the infant cleaves to the inherent sequences of behavior maturation. He remains faithful to his fetality even though birth has made him an infant. While he remains in the fetal cycle of his growth (between his pre-term birth and the fortieth postconception week) he should be regarded as a fetal-infant and so designated.

§ 2. PREMATURITY AND IMMATURITY

At no point in the cycle of human life do individuals present such a wide array of differences as at the moment when they are born.

This is due to the relativities of natal age, to congenital differences in physiological adequacy, and to constitutional differences both primary and secondary in behavioral capacity. Such a wide array of interacting variations has naturally led to confusions as well as difficulties in clinical terminology. The terms "prematurity" and "immaturity" are particularly in need of clarification. The relativities of natal age and maturity are specified in the following definitions.

1. A *fetus* is an embryonic individual *in utero.* The fetus becomes an infant at birth.

2. *Infancy* begins at birth, and is usually assumed to end at about 2 years of age.

3. A *full term infant* is an infant whose gestation period was approximately 40 weeks. It is sometimes specified that such an infant must have reached a length of 45 cm. from head to base of heel.

4. A *pre-term infant* (premature infant) is an infant whose birth weight is less than 2500 grams or whose gestation period was less than 37 weeks.

5. A *post-term infant* is an infant whose gestation period was more than 42 weeks.

6. The pre-term infant is called a *fetal-infant* from birth to the fortieth postconception week, as reckoned by menstrual age or birth weight age. He is a pre-term infant throughout the entire period of infancy.

7. The age of the fetal-infant (during the fetal period) is designated as *fetal age.* It is indirectly calculated by adding chronological age to the birth weight age.

8. The *birth weight age* is the fetal age at birth estimated on the basis of fetal weight norms.   ,

Calculating fetal age on the basis of birth weight age is an approximate rather than an exact method of determining age, because the factor of normal variation in weight is not taken into consideration. A considerable error is introduced if the fetal-infant is by inheritance exceptionally large and is reckoned (on the basis of weight) as being older than he really is. If the fetal-infant is unusually small, as so often occurs in instances of multiple birth, he may be erroneously considered younger than he really is, or regarded as a pre-term infant when he is actually a full term infant.

In twins and triplets, the discrepancy between actual fetal age and fetal birth weight age, calculated on the basis of single birth norms, may be quite large. Estimations of fetal age based on birth weight age alone must therefore be qualified and corrected as far as possible bv other developmental criteria.

Developmental appraisal must always be made in terms of maturity. Every organism no matter how young or how inadequate has certain degrees of maturity. These degrees may be expressed in age norms: anatomic, physiologic, and behavioral. The status of the organism should be described in the positive terms of maturity rather than in the negative and ambiguous terms of immaturity.

For this reason the category "immature infant" is of doubtful value either as a classification or as a diagnosis. An immature infant has been defined as any infant either of single or multiple birth, whether born at, before, or after term, whose weight is below 2500 grams. The implication is that the infant on account of "immaturity" is not completely prepared for normal extra-uterine life. Such a category would embrace an extremely heterogeneous group of neonates.

It will make for clarity if all infants are primarily classified on the basis of gestation age, and then are clinically characterized in terms of anatomic indices (body weight, height, head girth, etc.); behavior norms (motor, adaptive, etc.); and physiologic competence. This makes it possible to give weight to all of the biological factors involved. A diagnostic differentiation should be made between the immaturity which is based on physiological inadequacy, and the immaturity which is based on sheer developmental retardation. Retardation should be called retardation and not immaturity.

.Physiological inadequacy may be due to a constitutional instability. It may be consequent upon trauma or infection. It may be the reflection of an inferior growth potential or of the growth deficits of amentia. Or it may be a temporary insufficiency which will resolve with a readjustment of growth factors. Well endowed nervous systems are best equipped to produce and muster tonal reactions and to withstand the adversities of the birth process.

Virtually all neonates, pre-term, full term and post-term, suffer repercussions, mild or severe, temporary or permanent, from the stress of birth. Diagnostic differentiation is often difficult in the

neonatal period because of the complexity of all the variables. Differentiation, however, should not be obscured by the vagueness of such terms as immaturity and congenital weakness.

§ 3. BEHAVIOR DEVELOPMENT OF THE FETAL-INFANT

The fetal-infant, therefore, comes within the scope of developmental observation and it is profitable to appraise not only the vitality but also the patterning of his behavior. Under favorable conditions, he may survive premature birth at a fetal or postconception age of approximately 28 weeks. In the absence of abnormal complications, his survival depends primarily upon the maturity status of his behavior equipment at the time of birth.

The basic equipment is laid down in the first half of the fetal period. Behavior development is already under way at a postconception age of 8 weeks, when the fetus is a scant inch in length. Studies of fetal activity at that age have shown that stimulation of the oral region of the surgical fetus results in unilateral body flexion. At 9½ weeks a similar stimulus produces bilateral flexion— a kind of body swing. At 11 weeks hand stimulation evokes finger flexion. At 14 weeks the fetus can wink (with fused lids), can sneer and swallow; at 16 weeks it can make a single gasp. At 20 weeks torsion of the head arouses movement of the arm on that side. This marks the genesis of the important tonic neck reflex. At 25 weeks the fetus is capable of shallow but rhythmic pre-respiratory movements, which prepare him for the crisis of birth.

If this crisis is delayed another week or two he may survive. His viability depends in the first instance upon the tonal elasticity of his thoracic musculature and the tonal efficiency of his naso-palato-pharyngeal apparatus so essential to successful feeding, whether by dropper, feeder, gavage, or bottle. The behavior capacities of the fetal-infant are of critical importance in this early period. If his growth potentials are normal he will display progressive developmental changes in the patterning of his behavior throughout the period of fetal-infancy (through the postconception age of 40 weeks).

Elsewhere[*] we have reported the spontaneous and the responsive

[*] Gesell, A., in collaboration with Amatruda, C. S.: *THE EMBRYOLOGY OF BEHAVIOR: The Beginnings of the Human Mind.* Harper & Brothers. New York, 1945. P. 289.

behavior of a sizable group of fetal-infants. The observations, sup
plemented by cinema records, were sufficiently systematic to estab
lish well defined growth trends of behavior typical of three level
of maturity:

(a) *Early stage* of fetal-infancy (fetal age: 28-32 weeks)
(b) *Mid-stage* of fetal-infancy (fetal age: 32-36 weeks)
(c) *Late stage* of fetal-infancy (fetal age: 36-40 weeks; infant:
    who had been born two or three months earlier)

A brief summary of these three stages will indicate behavior
characteristics which have significance for developmental diagnosis
and for methods of care and management.

A. *Early-Stage Fetal-Infant (28-32 weeks)*

At the beginning of this stage the fetal-infant weighs only about
two pounds. He is so diminutive that he can be held in the palm
of the adult hand. He is fragile, scrawny and wizened, with under-
developed buttocks and legs. There is no adipose under the thin
dusky skin that covers his small bony frame. Occasionally he stirs,
but even when he is a few weeks older the distinction between
activity and rest is not clear-cut. He neither really sleeps nor wakes,
but only drowses, with brief ripples of bodily activity. Even his
torpor is fluctuant and shallow. Muscular tone is minimal, flaccid,
and uneven. Movements are so poorly sustained that their termina-
tions are more evident than their beginnings.

Nevertheless, behavior is steadily organizing and patterning. He
is seldom completely quiescent for any length of time. His complex
facial musculature is busy: he moves his eyeballs conjointly, later-
ally and vertically; his eyelids flutter; eyebrows lift; frontal brow
corrugates (sometimes only half of the brow, for bilateral integra-
tion is not yet firmly achieved): tongue protrudes, lips purse,
munch, and mince. Breathing is shallow and irregular and may be
out of tempo with momentary needs. Rarely he emits a faint bleat
or squeak; his cry may be soundless and is never prolonged.

His postural movements are sporadic and meager. In the supine
position he lies with head turned to one side; head rotations are
slight. He may extend the legs bilaterally or scissors wise and may
even roll to the side, reverting to a curved attitude reminiscent of

the rounded walls of the uterus. He straightens by mild stretching and relaxes into indifferent positions. Sometimes he arrests his arm movement into a transient catatonic pose; or he slowly elevates a flexed arm in a "floating" (t-n-r) pose.

He reacts to sensory stimuli. His fingers feebly flex on the tactile pressure of a rod inserted in the palm. He reacts with a small wave of activity to vibration and to sound. He blinks and frowns to a bright light. But he is heedless to a dangling ring. He can swallow and under certain feeding conditions he can even register satiety by behavior signs: but he is usually fed by gavage or dropper, at frequent intervals during night and day.

He makes no clear distinction between day and night. His sleep-waking-activity cycle has scarcely begun to take form. Ever-recurring torpor is his most conspicuous behavior trait. Nevertheless the young fetal-infant is busy with innumerable bits of behavior, which are not as detached as they seem. They are symptoms of a maturational process; they are incorporating within a growing, unitary action system.

B. *Mid-Stage Fetal-Infant (32-36 weeks)*

In physical appearance as well as behavior capacities the mid-stage fetal-infant seems definitely more mature. His anatomy is more compact, less molluscous. His skin is less loose, less wrinkled; it fits him more tightly because adipose has gathered beneath, except at the buttocks, where the skin still falls in folds. He seems slender rather than scrawny (he has nearly doubled his weight); and he is less flaccid, less apathetic.

All things considered, the most important developmental advance achieved by the mid-stage fetal-infant is his capacity for brief periods of wakeful alertness. He is still an indisputably drowsy individual. But again and again during the day and during the night he pricks the surface of mere being with small acts of awareness. He keeps his eyes more widely open and he opens them oftener. He shows more vivid distaste of a bright light. He does not fixate upon a dangling ring, with true inspectional regard, but when the ring is slowly moved he reacts with visual awareness: his eyes move saccadically in brief after-pursuit. He flexes on a rod with active grasp.

He shows increased responsiveness and adaptivity in his postural control. When he is picked up for bathing or feeding, his body tone picks up at least momentarily, to meet the challenge. His head station is palpably firmer; and his head is functionally more fully united to the trunk. Changes in trunk position induce active rather than passive changes in head posturing. In the prone position the head averts adaptively as though to reduce the hazard of suffocation. A vigorous infant, when prone, may even make a convexing movement like the hunch of an inch worm.

Supine, he readily assumes the t-n-r attitude. He holds it quiescently, or at times he activates it, flourishing the extended arm in a windmill orbit. He is capable of a larger amount of spontaneous postural activity, even though he generally husbands his energy in drowsy quiescence. When a gross motor action does occur, it tends to be more configured. It has lost some of the fadeout inconclusiveness of the early stage. His feeding and language behavior also is more robust and better defined. He can register hunger with a fairly lusty, though brief cry. He is capable of mild grunts and mewing sounds, to say nothing of yawns and sneezes. His suck and swallow pattern is sufficiently advanced to allow him to take food from a bottle or Breck feeder.

Having duly noted his positive behavior increments, it must be admitted that his total behavior day resembles that of a fetus rather than that of an active full term neonate. He is in general weak, indifferent, unresponsive. Even his sleep is indecisive, despite the promising punctuations of wakefulness. He is still a *fetal*-infant, unripe, unfinished. Grant him his drowsiness. He is under no compulsion to exercise the behavior patterns which nevertheless are undergoing their dormant maturation.

C. *Late-Stage Fetal-Infant (36-40 weeks)*

Compared with his earlier estate, the late-stage fetal infant presents a somewhat finished appearance. Adipose has rounded his contours and he may be almost chubby. He is physiologically more robust, and his behavior patterns are more clearly configured. Breathing, heart rate, blood pressure, and temperature regulation are better correlated; the internal environment likewise is steadier. He functions more smoothly in general. His body has acquired some

homeostatic wisdom and his behavior has had the polish of two or more months in an atmospheric world.

Accordingly his behavior day has more character. Rhythms of activity and rest are taking shape. His sleep is more expert. It has more structured pattern. A month or more ago, it was shallow, variable, fluctuant, and not always distinguishable from wakefulness. The mature fetal-infant has caught the knack of sleeping. He falls off to sleep more decisively, sleeps more deeply, clings to sleep more tenaciously. He awakes spontaneously at intervals and stays awake with or without fussing; but his emergence out of sleep is much less decisive than his "dropping" off to sleep. All of which reminds us that sleep is a complex function which needs intricate developmental organization, both at cortical and subcortical levels.

During wakefulness there are lengthening periods of visual and auditory awareness and heedfulness of internal states of being. Prone, he can momentarily lift his head. Supine, he can rotate his head through a quarter arc. He indulges in short cycles of spontaneous arm and leg activity, usually in the framework of the tonic neck reflex posture. His eye slits widen and he immobilizes on hearing a sound. At times, for brief moments, he immobilizes his eyes in a primitive kind of fixation, as though drinking in visual impressions in a diffuse and passive manner. Very sketchily his eyes move in a seeking kind of inspection, and they follow a moving ring some thirty degrees. At times his regard seems to be halted by the face of nurse or examiner. He cries more crisply. If fussing, he tends to quiet when picked up. Thus he shows the effect of experience as well as of his greater maturity.

It is instructive to compare his behavior to that of the *full-term newborn*, who (at a post-conception age of 40 weeks) has had no extra-uterine experience whatsoever. The full-term neonate begins his postnatal career with all the advantages which accrue from a normal period of gestation. He begins with a relatively mature behavior equipment and is therefore more ready for the transition to independent existence. But he pays at least a temporary price for this advantage; because he is in general more disturbed by the birth process.

It takes the full-term infant about two weeks to recover from the physical insults of being born. This is a period of adjustment. Breath-

Fig. 14. Reciprocal interweaving of prehensory behavior.

for diagnosis and for the care of the newborn; whether pre-term or full-term.

The trends assert themselves throughout the whole period of fetal and circumnatal infancy. They become apparent in the four major fields, and they are continuous with the growth trends which are charted in Appendix B, for 22 age levels from 4 weeks through 3 years.

This continuity is well illustrated in the developmental history of the tonic neck reflex, which is summed up by the accompanying diagram. At the postconception age of 12 weeks, the postural habitus of the fetus is symmetrical. It is capable, on stimulation, of approximating the hands toward the midline. At the fetal age of 20 weeks, as previously noted, rotation of the head to one side tends to produce extension of the arm on that side. This foreshadows a well defined t-n-r attitude, which is manifested by the fetal-infant at the early (postconceptive) age of 28 weeks. The t-n-r is a conspicuous feature of the spontaneous supine behavior of the post-fetal infant during the first 12 weeks of life. At 16 weeks it begins to wane; the head is more labile. At 20 weeks the head prefers the midline and tonic symmetry thereby takes the place of the t-n-r which had held sway. This symmetric attitude, also, is a tonic reflex—the symmetrotonic reflex (s-t-r). Like the t-n-r, the s-t-r holds temporary sway and is displaced by versatile unilateral coordinations, smoothly incorporated into varied postural sets for purposes of prehension and manipulation.

The t-n-r, therefore, is not to be regarded as a stereotyped reflex, but rather as a complex growing pattern, whose morphogenesis traces back to early fetal life and which advances through the three stages of fetal infancy and well into the period of post-fetal infancy.

Most of the behaviors of the fetal-infant undergo a similar progressive organization as indicated by the accompanying tabulation of growth trends. Motor activities, at first fluttery and inconclusive, advance to well defined flexions and extensions. Grasp, head rotation and head lifting, and eye movements become increasingly decisive. Vocalization progresses from squeaks and mews to a lusty cry. Feeding gains in competence as well as vigor. In the youngest fetal-infants sleep is shallow and undefined. In the mature fetal-infant four phases of sleep are distinguishable: (a) going to sleep,

(b) staying asleep, (c) waking, (d) staying awake. The embryology of sleep consists in a developmental differentiation and organization of these four phases. The mature fetal-infant is most advanced in phases *a* and *b*. He falls off to sleep and he clings to sleep.

Tonus like sleep is a form of behavior and is subject to similar embryological elaboration. Tonus is a condition of muscle tension mediated by both the autonomic and cerebrospinal nervous systems. It is not, however, a generalized quality or quantity which simply increases in magnitude. Tonus *is* behavior and it is patterned through growth processes.

In the youngest fetal-infants tone is minimal, flaccid, and uneven, patchy and precarious. It rises, falls, and shifts above its low level. It may be comparatively high in one region, and low in another. As tonus tires it seems to "wander" to fresher areas. This meandering characteristic is probably related both to morphogenetic factors and to the physiologic mechanism of recruitment. Muscle fibers are recruited and activated in squads rather than in their entirety.

Even in the mid-stage fetal-infant the tonal responses are more integrated. His gross postural activity comes in configured waves rather than in small localized ripples. His general tonus increases on manipulation and rises to meet limited emergencies. He is not as fragile as he seems; but his tone does peter out readily.

The late stage, near-term fetal-infant has more tone on tap. He does not need to husband his tone as formerly, because he has reserves of it to draw on. The whole substratum of tonus is more consolidated; he seems more firmly knit into a single, sturdy piece. He is more nearly ready to meet the buffetings of fate.

Now this progression toward organized tonus is the essence of the psychology of the fetus and of the fetal-infant. His mental life is mainly one of kinesthesia and tactility. His mental health has less to do with seeing and hearing. It has much to do with the satisfactions of bodily movement, and the ancient sensorium of skin and mucous membrane.

We can reach his psychic needs more fully by methods of routine care and management, which take into account his behavior characteristics. The behavior hygiene of the fetal-infant consists in the maintenance of optimal tonus. This is accomplished through ade-

GROWTH TREND CHART. *FETAL AND CIRCUMNATAL INFANCY*

This chart may be regarded as a preface to the normative GROWTH TREND CHART which is presented in detail in Appendix B, pp. 428-447. The latter chart tabulates behavior normatively characteristic (that is present in 50% or more of all cases), for 22 age levels from 4 weeks to 3 years. In both charts the growth trends for any given behavior are ascertained by reading horizontally across the chart from age to age. The lines of continuity are represented by leaders.

I (28-31 Weeks)	II (32-36 Weeks)	III (37-41 Weeks)	0-4 Weeks
MOTOR			
Supine—Small head movements (side position)	....	Turns head 90°	....
T-n-r. Floating t-n-r.]	....	....	....
Shoulder—Head droops	Slight retraction	Erects head briefly at shoulder	...
Prone—Minimal head rotation	Returns head to side	Lifts head Zone I briefly	Crawling movements
Tone—Minimal, flaccid	Moderate, increase on manipulation	Good, sustained	...
Rod—Brief, feeble closure	Active closure and grip	....	Hands fisted, clench on contact
ADAPTIVE			
Dangling ring—No response	Ocular pursuit movements	Follows 30+°	Follows 90°
Bell ringing—Wave of activity	....	Attends, quiets	....
Percussion—Wave of activity	Startles	....	....
Regard—Eyes open at times	Eyes open more widely	Pseudo-fixation	Indefinite regard
LANGUAGE			
Vocalization—Squeaks, mews	Soundless or brief cry when disturbed	Lusty, newborn cry	Small throaty noises
Expression—Small, twitchy face movements	Impassive face	Fusses or cries with waking	....
PERSONAL-SOCIAL			
Sociality—No response	....	Passive regard	Attends, quiets
Feeding—Gavage or dropper	Breck feeder or bottle	Bottle or breast	....
Sleep—Undifferentiated	Brief periods of wakefulness	Differentiated	....

quate physical care, but if we think of tonus in terms of behavior, we shall not pay exclusive attention to temperature, humidity, body fluids, and metabolic level. Tonus reacts to these factors and can be partly controlled through them, but it has its true origin in the structural maturity of the organism. The fetal-infant himself initiates the primary tonal responses, and they need discriminating consideration.

The scope of these responses in turn is profoundly influenced by the environmental impact of clothes and bedding, and of methods of cleansing and handling.

The fetal infant is not as fragile as he is often supposed to be. He needs skillful handling rather than no handling at all. If he were still in the uterus, he would have the benefit of jolting, jarrings, impacts, changes in position, and travel with the activities and goings and comings of the mother. Does he not miss these experiences when he is immobilized day in, day out in an incubator?

Clothing which combines snugness and freedom makes it possible to manipulate the infant with a greater degree of safety, and to provide him with needed translations in space, stimulating his semicircular canals and his kinesthesias.

Handling should be brief, because tonus readily tires; but if it is dextrous and done with dispatch, the fetal-infant is likely to acquire a quality of hardiness instead of the softness which necessarily comes with unmitigated hospitalism.

Fortunately, the maturational insurance factors are so strongly entrenched that they protect the fetal-infant to a great degree even from faulty methods of care. But if we are to bring his potentialities to the highest realization we must study more closely his total behavior economy. His psychological needs are most clearly manifested in his basic muscle tonus and his patterns of tonal behavior.

CHAPTER XVI

PRECOCITY

§ 1. NORMAL AND ABNORMAL ACCELERATION

The word precocity is freely used both by the laity and the profession, but in such variable ways that it is worth while to examine a few of its connotations. Literally the word means "cooked too soon." Often it is made to imply untimely ripeness, premature fruiting, undue earliness. In this sense a precocious child is one who is too forward, who is ripening before the proper time, who is developed more than is natural.

Precocity is evidently a kind of developmental acceleration. It represents a speeding up of development far in excess of the usual tempo. Acceleration is comparable and converse to retardation. It denotes a quickened tempo as measured by age norms. When the quickening is general and inclusive it is registered in a consistently high D.Q. But like retardation it assumes a large variety of clinical forms. It may be partial rather than generalized; the rate of acceleration may be even or uneven; the dynamic quality of the behavior may be enhanced as in retardation it may be deteriorated. Retardation often carries with it a shortening of the total period of growth. Acceleration on the contrary may lengthen the period of development, even though the ontogenetic tempo is hastened.

Precocity, therefore, should not have an adverse connotation. It has a favorable import, when it is a biological form of super-deviation. Whether any acceleration is normal or abnormal depends upon whether it augments or diminishes, strengthens or disintegrates the total cycle of growth. This cycle is regulated by timing factors (time genes, hormones, pace makers, etc.). When these timing factors for germinal or postgerminal reasons are disharmoniously altered,

the acceleration becomes pathological. When, as is most frequently the case with respect to mental growth, the innate timing mechanism is affected in a uniform and coherent manner, acceleration may be a symptom of giftedness, or even of genius.

Abnormal manifestations of acceleration occur most strikingly in the field of physical growth. Precocious puberty may produce an infant with hair on the pubes and with menstrual signs at birth. Moreau's giant boy weighed 16 pounds at birth and had a beard at 7 years (Ballantyne). In progeria the signs of premature aging may appear as early as 6 months. When the timing factors are extremely disordered, gigantism of the fetus (macrosomia), accelerated ossification, arrested development and postmaturity may occur in paradoxical association. Such extreme anomalies are fortunately rare, but they serve to remind us of the milder and more benign forms of acceleration and retardation, which find their way to the clinic and to the doctor's office.

Parenthetically it should be pointed out that uncomplicated postmaturity does not involve precocity or acceleration. The infant is born with abilities well in advance of his chronological age; he is further developed than the ordinary neonate, but this is a pseudo-precocity; for he is at a normal level of ontogenetic maturity. His precocity vanishes as soon as his true age is computed.

And now for some examples· of genuine precocity, with special reference to the first three years of life. Sir Humphry Davy, scientist, walked at the age of 9 months and spoke fluently before 2 years of age. Friederich Wolf, scholar, enunciated clearly before the age of 2 years, began to write and study music at the age of 3 years. Torquato Tasso, writer, spoke clearly at 6 months, pursued grammar at 3 years and soon took up letters and humanities. Coleridge and Jonathan Swift read the Bible at three; Voltaire read Fontaine at the same age. Albrecht von Haller, scientist, delighted in making books, financial accounts, and dictionaries at 3. Macaulay had ceased to care for toys at the age of 3, but liked talking and telling stories. John Stuart Mill learned Greek at three; Mozart, the clavier at the same age. Thomas Arnold of Rugby, as an infant, made such a creditable record for scholarship that when he was 3 years old his father presented him with Smollett's twenty-four volume history of England. Although three is not a critical age, it seems that many forms of

talent and giftedness declare themselves by developmental symptoms before that age.

From such examples we can only conclude that some kinds of precocity are normal in the sense that they are authentic indicators of the adaptivity of the nervous system. To what extent these linguistic and academic expressions of precocity were induced by cultural pressure it is hard to determine; but we may be certain that exceptional growth potentials were present. Intellectual prodigies cannot be created by environmental pressure alone, although it is said that our colonial period was an age of child precocity because in that time overzealous parents pushed their children forward in the classics when they were scarcely out of the cradle.*

In the next chapter we shall discuss the reverse side of this picture under the heading of *environmental retardation*. It will be shown that certain institutional environments can depress language development and produce a symptomatic complex which resembles primary retardation. Articulation, speech, and expressional behavior become bogged down. In some of its manifestations precocity may be regarded as a form of *environmental acceleration*. It may reflect a disproportionate emphasis on verbal behavior; but such over-stimulation can scarcely produce primary acceleration. It is more in the nature of excessive specification and over-organization.

A pair of extremely superior and gifted twins whom we studied over a period of years, could talk in sentences at the age of 11 months (the normative average for a three word sentence is 2 years). These twins began to study French and Esperanto at the age of 3 years. They had an adult vocabulary at the age of 8 and almost identical I.Q.'s of over 180. Despite all this, they were not prigs; they were attractive, animated, sociable children, with a bubbling sense of humor. Well-defined speech prior to the first birthday, however

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* President Timothy Dwight of Yale College was one of these children. So was a daughter of the President of Harvard College. She was born in Boston in 1708, and at 3 years of age (again three!) she could recite psalms, poetry and most of the Assembly's Catechism. Richard Evelyn had learned all of his catechism by the age of 30 months. Of him it is recorded that "the number of verses he could recite was prodigious, and what he remembered of the parts of plays which he would also act; and, when seeing a Plautus in one's hand, he asked which book it was, and being told it was comedy and too difficult for him, he wept for sorrow. . . . He was all life, all prettiness, far from morose, sullen, or childish in anything he said or did." But he died in 1658, at the premature age of 5 years and 3 days.

dependent on models for imitation, can scarcely be ascribed to environmental forcing. It represents an inherent growth characteristic, biologically determined.

From the foregoing factual data it becomes apparent that there are diverse forms of acceleration paralleling in many respects corresponding clinical forms of retardation. The underlying embryogenesis and developmental physiology must be the same for all grades of humanity. Prodigies may be marvelously extraordinary; but they belong to the human species and are subject to the same laws of developmental morphology which determine the behavior patterning of the mediocre, the dull and the inferior. The superior child is simply superior in the speed, the complexity and the subtlety of his reactions. The whole range of human abilities can be placed on a single developmental gradient; they can be approached by methods of diagnosis and of guidance which are in principle identical for subnormal and superior. In this broad sense, acceleration no less than retardation presents practical clinical problems. The physician can ill afford to brush aside all evidences of precocity, as either harmful or harmless; as something to be combated or ignored.

Acceleration assumes many different forms, which need individual attention. The emotional characteristics of a highly dynamic or gifted infant sometimes create special problems in management and child care. Superior children as well as subnormal children can be misunderstood. Allowances must be made for their "strength of will," their assertive craving for social experience, their strong drive to self-help or their extreme sensitivity as the case may be. Such infants do not always have a reputation of being "good babies," although usually their innate intelligence causes them to make good adjustments to requirements which are consistent with their welfare. Needless to say temperamental traits as well as maturity level must be considered. An infant of superior behavior equipment is likely to have well-defined emotional traits and may prove to be not as acquiescent as a more mediocre individual.

Whenever the physician is called upon to give advice in connection with foster home placement or child adoption, it is especially important that the evidences of superior endowment should not

escape notice. Infants and young children of superior promise should be placed in homes that offer good educational opportunities.

Because of the increasing emphasis on the positive aspects of health supervision it becomes incumbent on the physician to have a diagnostic eye for favorable as well as unfavorable deviations. It is not his province to attempt over-precise and prophetic pronouncements as to a child's intelligence; but he should recognize symptoms of superior endowment and take them into account in his advisory guidance.

§ 2. Symptoms of Superior Endowment

The symptoms of superior endowment in infancy can be considered under two headings: developmental and dynamic. The first have to do with the natural growth characteristics of the child; the second with the way in which his superior behavior equipment functions.

These symptoms assume varied constellations. Superiority is not a rigidly defined entity. There are many different syndromes. The term itself is a rather bare abstraction; but it takes on meaning when it is contrasted with inferiority and dullness. It should not, of course, be restricted to intellectual ability, but should be applied to all socially valuable abilities, including the capacity to comprehend and to manipulate human relations.

Superiority like amentia is a protean term. Generalizations are hazardous. In an infant, superior endowment is denoted as a heightened capacity to grow and to assimilate. This capacity is not easy of diagnosis in its early manifestations, although we may safely assume it is present from the start. Diagnostic norms and cultural habits are better suited to reveal subnormality and inferiority. Latent powers are often so masked or obscured that it takes exceptional clinical insight to recognize their symptoms. Nevertheless there are several types of infants who display recognizable symptoms to a significant degree, under the conditions of the developmental examination.

Developmental symptoms. Developmentally, as already indicated, acceleration is a major symptom of superior potency. It may not be a universal symptom but it is nature's favorite method of loading the dice. When she is most prodigal she not only hastens the

ontogenesis, she lengthens its total duration. And to make trebly certain she intensifies the speed of adaptive reactions. By these three devices the organism gains a tremendous amount of extra time over its more pedestrian companions. In the end society benefits from this extra time, but the devices themselves are essentially biological and to some extent open to observation and measurement.

The ratings on the developmental schedules do not always give clear evidence of acceleration in the first year, although posture and locomotion are sometimes advanced. The acceleration comes into clearer prominence in the second and third years with the development of speech, comprehension and judgment. However, personal-social adaptations and attentional characteristics are usually excellent even in the early months. Although the scorable end-products may not be far in advance of the age norms in early infancy, a superior quality is clinically manifest in the manner of performance.

It is scarcely necessary to suggest that well-defined developmental acceleration nearly always has an hereditary basis. It is determined in the germinal constitution by the timing mechanisms which govern both antenatal and postnatal development. The acceleration is more or less general; but it is also specific for individual characters, physical and functional. It is not surprising that distinction tends to run in families. Nor is it surprising that distinctive ability is constantly emerging from the so-called masses. It is entitled to early recognition wherever it appears.

Dynamic symptoms. Whether he arrives at a given stage of development before his time or not, the superior child shows excellence in the way in which he performs. He is emotionally sensitive to what is happening in his environment. He looks alertly; he draws inferences as manifested by his intelligent acceptance of novel situations; he establishes rapport; he co-operates. In concrete ways he shows insight and foresight in the complex of events that comprise his visit to the doctor. Once the examination is under way he gives focal, marginal and anticipatory attention to the test situations. He shows resourcefulness in exploitation; he shows initiative, independence and imitativeness; he is likely to give a good performance even if he happens to be somewhat irritable or sleepy. In a child of inferior endowment, some of these behavior traits would be lacking altogether, or they would be present in bland rather than vivid

form. Even during the first year of life the positive behavior characteristics are so well defined that one uses, by way of description, adjectives which are usually reserved for older children:—poised, self-contained, discriminating, mature demeanor, etc.

When there is no frank acceleration, superior endowment declares itself in the dynamic intensification and organization of the behavior assets. The total output of behavior for a day or a week proves to be more abundant, more complex and subtle than that of a mediocre child. When these dynamic differences are recognized it becomes clear that there are infants who may be characterized as superior in their own present rights, as well as in their promise.

In the foregoing characterizations we have dealt with more or less typical symptoms. Individual differences are great. When giftedness is limited to relatively few fields of behavior, we think of the individual as talented. Sometimes the accentuated development of specific fields is very disproportionate; the behavior picture is imbalanced. The imbalance may be severe enough to be regarded as abnormal. But in its more frequent and characteristic manifestation, superior endowment reveals itself in coherent, versatile and many-sided excellence. It is often associated with charming personality traits. The popular conception that precocity in itself is unwholesome, is not sustained by clinical observation. In the preschool years in particular, before the child has suffered from unwise educational methods, he presents an attractive and challenging picture.

The following brief case sketches and comments will serve to indicate concretely the nature of the symptoms and syndromes as they are encountered in the early years.

CASE 1 was born with one tooth erupted. Motor behavior was also accelerated. At *28 weeks* she was able to pull herself to a standing position and cruise; she climbed one step of the stairs on the first attempt. Energy, perceptivity and sociability all were advanced for her age. Language and adaptive behavior were not very unusual. At *40 weeks*, adaptive behavior was more conspicuously advanced. Performance was at a 56 weeks level, with incipient thrusts toward 15 months. At *1 year* performance had reached a full 15 months level. Special note was again made of the attractive personality traits. At *18 months* she functioned at a 2 year level; at *2 years*, her language, adaptive and personal-social behavior were rated at a 3 year level. Motor behavior was rated at a 27 months level. At *3*

and at *4 years* behavior remained consistently advanced and the record continues to characterize her as a well-poised, co-operative girl who obviously enjoyed every moment of the examination, and who exercised her initiative by introducing demonstrations of her own.

This is a gifted girl, but in no untoward sense a prodigy. The developmental and educational outlook is definitely superior. The acceleration probably has an organic, hereditary basis as betrayed by the telltale tooth at birth, a history of motor precocity in the father's family, and evidence of similar precocity in a baby brother. Note that acceleration in adaptive behavior was discernible as early as 40 weeks of age.

CASE 2 was taken off the maternity ward for adoption. She was known to be the offspring of well educated parents. This fact has added support to the high opinion which we soon gained of her developmental potentialities. At *8 weeks* she gave no evidence of advanced status; but at *20 weeks* her performance proved to be definitely above the average. Her drive was strong, tense, almost excited; her manipulation so active that it resulted in a two-stage transfer of the ring. At *40 weeks* her adaptive behavior almost attained a one year level. She made a determined effort to place the pellet into the bottle. She took huge delight in the whole examination and displayed a mature kind of amiability in her co-operativeness. At *2 years* there was the same excellent rapport with the examiner. Her responses were immediate, decisive and of excellent quality. Her performance was above the 30 months level in the motor and language fields. In a nursery school group at *2½ years* she is credited with superior postural control, versatility in jungle gym play activity, adeptness in solving mechanical problems, a delightful sense of humor, and a capacity to protect her own status without aggressiveness in the social group. She is an attractive child with undubitably superior growth potentialities.

She is another example of the frequent type in which favorable personality traits with vital drive are associated with general developmental acceleration. Such an association usually augurs well.

CASE 3 first came to our notice at a Well Baby Conference at the age of *11 weeks*. He immediately impressed the examiner by reason of his beautifully developed and large physique, and his smiling, amiable demeanor. On the developmental tests he was definitely above the average in all fields even at this early age.

At *15 weeks* he made a similar showing and was still blithe and smiling after a two hour sojourn at the clinic. Eight periodic examinations were made during the course of the first year and all showed sustained ac-

celeration in all fields of behavior with the partial exception of language. At the age of *1 year* the three weeks of acceleration noted on the first examination age 11 weeks had lengthened to three months. At *2 years* he rated at a 30 months level with language near average expectation. At *3 years* language was again in relative arrears. At *6 years* the behavior picture no longer suggested superior endowment. It was near average. The quality of the responses was quite ordinary.

This case raises several questions which it must be confessed we cannot answer. This boy was the ninth child of a family of very average status. Environmental conditions in a crowded household may have operated disadvantageously, as shown, perhaps, by the relative lag in language development. It is possible for a well endowed child to suffer a considerable degree of environmental retardation. On the other hand we may not be dealing with a case of fundamental superiority. The boy may not have inherited genuine giftedness, but a deviation in timing mechanisms which accelerated fetal and early postnatal development. He weighed 11½ pounds at birth but on the basis of the history was not postmature. All the siblings were heavy at birth. This appears to be a familial or at least a prenatally determined trait. It may represent a deviation in timing factors. This deviation may be undergoing self-correction as evidenced in a general deceleration which is returning the child to a biologically more normal average. Genuine deep-seated precocity does not exhibit such a course of development unless the environment is extremely adverse. Although our questions remain unanswered, they show the complexity of the issues and the need of clinical caution.

CASE 4 in infancy raised similar questions, for which we have more decisive answers. He supplied the answers in the form of his own growth career. Favorable expectations were awakened as early as the age of *8 weeks* when he made a highly favorable impression on the examiner. He was born in a home of average socio-economic status of undistinguished parents. We made 14 developmental examinations during infancy and the preschool years. We saw him again at the age of 12, after a lapse of seven years. He fully satisfied our anticipations. He was an alert, responsive, attractive boy, poised in manner, with a steady penetrating gaze. Although not a prodigy in school, he has shown strong drives and inventiveness in engineering fields. He handles with ease such polysyllabic words as

equilibristic and inapplicability. He rates near an 18 year Binet level with an I.Q. of 150.

Along the whole pathway of his development he gave evidence of his superior biological endowment. Evidence of acceleration is reflected in the 8 examinations recapitulated below.

Age 8 weeks: Alert, responsive, ready social smiling.

Age 16 weeks: Advanced in both adaptive and motor abilities.

Age 40 weeks: Rates near 12 months level. Articulates words. Stands a moment without support.

Age 12 months: Vocabulary of 6 words. Builds tower of 3 blocks.

Age 18 months: 40 words and phrases. Amazing feats in climbing.

Age 3 years: Developmental level, 42 months. Interest, attention, and social adaptations excellent.

Age 5 years: Mental age 6½ years.

Age 12 years: Vocabulary average adult level. Mental age at a superior adult level. I.Q. 150.

It should be recognized that high average ability and the milder forms of superiority are relatively common and call for no special measures. Every case of acceleration must be appraised on its own merits. In the vast majority of instances the developmental outlook is entirely favorable. Wholesome precocity is benefited by healthy satisfactions. Children should not be forced by hothouse methods, neither should they be kept back, as is so often advised. Parents should not be made too conscious of the more ordinary forms of superiority; but if the acceleration is of an unusually high order, if it is imbalanced, or associated with emotional difficulties, it may need special attention.

Intellectual behavior may be far in advance of personal-social behavior because emotional development even in the superior child tends to be conservative. For this reason he may show a relative lag in his capacity to make social adjustments. The accelerated child needs social experience with children of his own age and social maturity. He should learn to get along with them in the preschool years. In all instances the chief aim should be the protection of personality factors.

CHAPTER XVII

ENVIRONMENTAL RETARDATION

§ 1. ENDOWMENT AND ENVIRONMENT

Throughout this volume we have recognized the close relationship of hereditary and environmental factors in the development of behavior. Indeed the dynamics of development consist of an interaction between intrinsic and extrinsic determiners. It is a reciprocal interaction. Growth is a process of integrative organization which brings "heredity" and "environment" into productive union. It is only through growth that experience becomes incorporated into the maturing nervous system.

Growth, therefore, is constantly creating its own conditions as it proceeds. The products of present growth influence later growth. The manner in which an organism functions today must have some effect on how it will function tomorrow. For this reason the resultant patterns and limits of growth are never completely predetermined. In the prognostication of development, surely, much depends upon what happens to a child!

How much? That is always a clinical question which demands an estimate of the inherent growth potentialities in terms of a given environment. Sometimes the environmental factors seem so significant that a new environment must be provided to put the question to a therapeutic test. The problem is one of differential diagnosis, which requires a discriminating estimate of the environment as well as of the organism. Or rather it requires an estimate of the fundamental responsiveness of the organism to its environment.

This responsiveness is the crucial variable. It is a kind of algebraic sum of the growth potentials of the individual and the stimulus

values of the environment. There are enormous individual differences in original capacity; there are equally diverse differences in the psychological patterns of environment. Optimal growth is achieved when child and environment are suited to each other.

These general principles become very pointed in clinical situations; they then lose their abstractness. We are called upon to decide whether Baby A would do much better with different care; whether Baby B is being held back by institutional surroundings; whether Child C should be placed in a more stimulating foster home. We may wonder why Child D does so well even under the very poor conditions to which he is subjected. It seems as though some children can "take it" much better than others. We are always dealing with a reciprocal relationship, an interplay of individual and environment.

In appraising growth potentials we cannot ignore environmental influences: cultural milieu, siblings, parents, sunshine, illness, trauma, education. But these must always be considered in relation to primary or constitutional factors, which ultimately determine the degree and mode of reaction to the environment. The organism participates in the creation of its environment.

When this relationship is a fairly balanced one the trends of mental growth are likely to be regular and consistent. Whether the child is subnormal, mediocre or superior, the course of development typically assumes an even tenor and tempo. When, however, the balance is uneven, when the organism is overtaxed or undertaxed, the course of growth also becomes uneven; the D.Q. may undergo fluctuation or actual decline from age to age. Certain patterns may lag; others may be disproportionately advanced. The total pattern of growth becomes poorly integrated. Under prolonged institutional conditions the behavior growth may languish. Environmental impoverishment leads to behavioral impoverishment. It produces palpable reductions of behavior. This is not to say that it produces mental deficiency; but it does produce symptomatic syndromes which are severe enough to make diagnosis difficult and to call for therapeutic intervention.

The growth career of Christine is a case in point. An illegitimate child, she was placed in institution A where she remained to the age of 17 months; she was then placed in foster home B; at 29 months, in adoptive home C. Three examinations were made during her

long institutional period,—and 17 months is a very long time for an infant. On each of these examinations she was clinically adjudged as dull normal. With more superficial diagnosis she might well have been considered feebleminded, because she was definitely retarded on the developmental schedules. At the age of 35 weeks she still regarded her hands after the manner of a 12 weeks old infant. But this and other behavior characteristics were attributed to the unfavorable institutional environment. Her subsequent career can be briefly told. As she progressed from less favorable to more favorable environments, she improved in her showing on examination in almost exact proportions, and so promptly as to make the relationship convincing.

After six months of foster home experience, she earned a dull normal to low average rating. Four months later a low average status was indicated. Placement in adoption (with a full year of probation) was recommended. Seven months after she had entered her adoptive home, her development had risen to a full average level. A half year later it was slightly above average. The examiner's comment was, "Christine's adoptive placement seems ideal."

Why did it seem ideal? Because at last there was a compatibility between her capacities and her opportunities, between her surroundings and her behavior assets. She was neither under-placed nor over-placed. If in her institutional days, at the age of 35 weeks, she had looked at her hands it must have been because she had nothing better to do. Now she has constant chance and occasion to exercise her growing powers. This makes for her happiness. It also is a safeguard against developmental deviation.

The case of Christine may serve to show why a D.Q. fluctuates from one examination to another, and why the course of development for some children is more irregular than it is for others. Growth potentials are primarily determined. Their limits are fixed by inheritance and constitution; the growth potentials come to realization in experience. The character of the environment, of course, has considerable effect upon the character of the experience. But experience does not create new potentials, nor does it destroy the original potentials. It cannot make a genius out of an ordinary child, nor does it make an ament out of him, even if the D.Q. is depressed to a subnormal level. An ament cannot be lifted to normal mental

efficiency by the most favorable environment. An environmentally retarded child responds in a significant way to a more favorable milieu. His D.Q. rises and reflects the improvement.

In a similar way, though usually not to the same degree, the D.Q. of an ament may fluctuate with improvement of environmental conditions. But as already stressed in previous chapters, a normal child is normal and remains, in a developmental sense, potentially normal under environmental adversities. An ament is and remains an ament regardless of alterations of environment.

We do not assume that a D.Q. is a perfect index of developmental status. For this reason clinical appraisal is a necessary supplement and corrective. The D.Q. is, however, a sufficiently sensitive index to register and to signal the backstrokes of seriously inadequate environmental conditions. Other things equal, when there is a normal correspondence between endowment and environment the trends of mental growth tend to be regular, and the D.Q. relatively constant. We use this general rule as a normative line of reference to facilitate the recognition of deviations whether in subnormal, superior or average children. Clinical judgment is then used to appraise the child in terms of the environment, to assess the environment in terms of the child, and to estimate the strength of the growth potentials which may compensate for distortions and retardments.

§ 2. INSTITUTIONAL SYNDROMES

Many babies and young children are obliged to spend much of their lives in institutions, hospitals, and congregate nurseries. It will be profitable to consider briefly the environmental effects of such surroundings. It is, of course, understood that the personnel and organization of any institution (even a family home for that matter) determine its benefits and its hazards. We shall, therefore, discuss the subject from a functional standpoint and show how the typical patterns of institutional arrangements enter into processes of infant development. It is not our purpose to discuss abuses. We are not concerned with substandard and unsanitary institutions; but with reasonably well conducted, humane institutions, which are usually doing all or even more than should be expected of them. To appreciate the effects of such institutions on the welfare of infant

development, we must objectively analyze the dynamics of their equipments and methods.

In both poor and good institutions one is likely to find devoted workers who have deep insight into the needs of child life. They recognize the handicaps under which they work. We are not attempting, here, to suggest how institutions should be run or improved. It is our duty, however, to describe in concrete clinical terms the impression which prolonged institutionalization makes upon the behavior characteristics of infants and young children. Our experience has unmistakably shown that institutional environments create distinctive syndromes which tell their own story,—but which can be defined only through the technique of a developmental examination. The examination exposes the environmental forces which are obscurely at work, deflecting and depressing the developmental patterning of the child's behavior.

In the following portrayal we envisage an XYZ institution of near average size, moderately well staffed and equipped, and under medical supervision. The children range, shall we say, from a few weeks to a few years in age. The population is ever changing. Some children come on a brief emergency basis, but there is a strong tendency for all to remain longer than was intended. The institution has a good local reputation for the care which it bestows on its charges. Some of them have come from miserable homes. The general level of the education and intelligence of their parents is low average rather than high average, but there are always some exceptions in both directions of the mentality gradient;—a few very bright, others not so bright.

Psychologically speaking, the children who fare best in this institution are the very youngest babies. They are on a schedule; they are getting regular and frequent physical care. This physical care coincides pretty well with their current psychological needs. The bath, the cleansing, the rubbing, the changing, the dressing, the undressing, the weighing, all add up to a fairly busy and slightly exciting behavior day, particularly when so much time is expended in sleep, in staring, and in esoteric sensory experiences which are possible to a baby in almost any crib or bassinet anywhere. The young infant doesn't need much more than he is getting. A hospital,

an institution, provides at least a major portion of his most basic needs, both physical and mental.

As the baby grows older his basic physical needs remain much the same, but his psychological needs increase with every day. In a busy institution the physical care continues, but the progressive, new psychological needs are only partially met. There are too many babies and not enough affection to go around. Not every baby can have individual attention, so no baby gets that intimate and special consideration which he enjoys and profits by in a family circle. In a family he becomes the very center of attention. The household more or less revolves around him. In an institution the design for living is altogether different. There is no single center, because an institution is not a monogamous arrangement. There are multiple, shifting centers and multiple "mothers," who may change from time to time so that an infant will have several such adults in *loco parentis*, in the course of a few weeks or months. Indeed he may have a succession of different caretakers in the course of twenty-four hours. In a family home he has the continuity of the domestic circle. This continuity, day in day out, builds up a sense of security and identity. In an institution there is an excessive amount of discontinuity, particularly with respect to personal contacts and relationships. The result is an enfeebled sense of security and a blurred sense of identity.

The baby belongs,—to what and to whom? To the institution. Sometimes the very vastness of the rooms and the repetitive multiplicity of furniture prevents the building up of natural associations with a settled and a comprehended *place*.

The young infant is now straining to sit up; he wishes to survey the world in horizontal and oblique visual planes; he is developing new powers of ocular fixation and ocular pursuit; he is picking up moving objects with his eyes; he is ready for increasingly varied visual expeditions. He has a veritable hunger for perceptual experience, a thirst for elementary knowledge of the physical world. Are this hunger and thirst satisfied? Only partially, because of the inevitable limitations of XYZ institution. He is propped up, possibly at regular intervals, and for predetermined periods; but not always at the psychological moments which are most favorable; nor with the endless variations and surprises which naturally enter into the

flexible living of a domestic circle. The caretaker having propped him for the sitting-up period, even places a toy at his disposal. But the propping is of necessity done in a somewhat hurried and impersonal manner, because the very same attention must be repeated for a sizable number of babies. There can be no waiting for and adaptation to psychological moments. There is too much to be done. Nor is there much time for improvisation-play with the baby. In a well ordered family home, however, there are innumerable psychological moments during the day. The mother or nurse helps to create them and is on the alert to detect and to exploit them. That is the supreme advantage of the home over the institution in the matter of psychological care.

Superficially the difference in the two environments may seem very small, but over the course of months this difference proves to be far reaching. The home builds up the psychology of the baby by countless opportunistic impacts varied to meet the fortuities of each day. The institution tends to channelize the psychology of the baby by restricted and somewhat standardized impacts. It delimits the scope of the infant's behavior by paucity of impacts. This paucity has nothing less than an impoverishing effect.

We see the effect in the behavior syndromes elicited by the developmental examinations of institutionalized infants, by the time they are from 16 to 28 weeks of age. These infants often react better in the supine test situations than they do while seated at the test table. They are accustomed to lie on their backs—over-accustomed in fact because they have acquired exaggerated, circular forms of hand play, hand and mouth play, head nodding and head rolling. Such activity becomes congealed into stereotypy,—into blind alley behavior patterns which have not been sufficiently sloughed off or displaced by normal developmental elaborations. Even hand inspection, which should be dropping out of the picture between 16 and 20 weeks, may usurp other forms of activity and assume an unnatural dominance at 24 weeks. Why not? The child has spent an unnatural preponderance of time on his back and has become an over-expert hand inspector,—hyperplasia rather than morphogenetic differentiation.

In the seated position he begins to show his limitations. He may not even look at the cube on the test table. He looks at his hand

instead; or he fastens a transfixed gaze on the examiner, smiling blandly in an over-fascinated manner. He is over-fascinated because the examiner is a novel sight. An XYZ baby has very narrow experience with persons. This produces a certain social ineptness. His narrow social experiences have narrowed the scope and adaptability of his social behavior.

The end result is a species of environmental retardation, revealed by the developmental examination: a 24-week-old baby scarcely giving heed to the table top or the cube thereon; not bending his head to the task in hand, but instead, gazing inordinately at the examiner or looking recurrently at his own hand, with semi-automatic jerks of attention.

Why, he doesn't do as well as an ordinary 20-week-old baby, you say to yourself; and it is true, for even a normal 20-week-old baby will avidly concentrate his ocular, manual and postural powers upon the focal object on the table top in an effort to corral it.

The retardation of the 24-week-old institutional baby may only be slight, but it is significant. It becomes increasingly serious if that same baby stays in the same institution for a half year or perhaps a whole year more. Environmental retardation works by attrition as well as by impoverishment. Effects tend to be cumulative in susceptible infants. Increased maturity does not bring increased power to overcome these effects; because it is only a partial maturity which comes, and because the behavior patterns are incessantly organized to accept the institution. The most susceptible infant is the infant who most completely accepts.

The very acceptance may reach an abnormal degree of intensity. The baby becomes overweaningly attached to the institution; not so much from sheer love of the place as from ignorance of other places. By the age of 1 year he may be terrified to be taken somewhere else; he resists strangeness; he clings to the attendant; he cries. The new situation is altogether too much for his limited experience and for his atrophied adaptability. The social ineptness noted at the age of 24 weeks is coming to its developmental issue.

His resistances should not be interpreted as abnormal fears; they are perfectly natural emotional manifestations of restricted and restrictive personal-social patterns of behavior. They are the products of over-channelized and meager social experiences. The XYZ type

of institution in spite of its high standards is not arranged physically or personally to supply a well balanced social dietary. The vitamins are left out.

Contrast the typical behavior of an average 1 year old child who has been brought up in ordinary home surroundings. He may show shyness in a new situation (we rather like to see him show it); but he thaws out, he sizes up, he adjusts emotionally. Confidence mobilized, he bends to the tasks of the developmental examination with eagerness. There may even be a burst of protest as he is about to leave. He enjoys new experiences; he profits by them; he gets them in abundance.

In the development of personality, one of the most critical transitional periods is that between 1 and 2 or 3 years. Woe befalls the child who does not get discriminating individual attention during that difficult period,—when more or less simultaneously he is learning to walk, to talk, to acquire a sense of personal identity and of possession, a reciprocal sense of other persons, an adaptation to strange social mores including bladder and bowel control! The demanded controls are so multifarious that the institutional child, being subjected to less insistent cultural pressure, may seem to have some advantage over the household child. But the institutional child pays too heavy a price for this apparent leniency; he lacks the stimulus that comes from the changing, albeit sometimes excessive, tensions of family living.

First and foremost the child in Institution XYZ lacks the normal tensions of language,—the tensions of intercommunication by facial expression, by gesture, by pantomimic action, by social laughter, by interjections, by words and sentences, and by other forms of expressional behavior, both on the give and the take sides, which occur in the intimacy of home life. No matter how noisy the institution sometimes is, on account of wails and crying, no matter if the footsteps and activities of the caretakers break the quiet, a veritable pall of noncommunication tends to hang over the nursery where the run-abouts and the creep-abouts are congregated. At first blush they seem to be having a fine time. It is a smooth expansive floor, and they are excellent creepers. Some indeed are creeping who under other auspices would be walking. Just as the institution puts an unconscious premium on supine behavior for the young infants, it

overweights prone behavior in the older infants. But this arena of quadrupedal and bipedal locomotion is relatively devoid of speech. There is little social laughter. Even the crying has lost much of its language value. It is a primitive form of emotional release. There is no jargon among the children; very little per capita conversation between adult and child.

Picture the scene: a dozen or a score of infants on the floor, getting in each others way, or occupying islands of isolation; the play objects are promiscuously exploited in a fragmentary manner; there are no cohesive, continuing small groups with an adult and a baby as a focal center of the group. There are no stable focal centers; the centers are ever shifting; the activities are scrambled and more aimless than they would be in an ordered home. Toys and possessions are communal. This is a kind of ordered chaos so far as patterned personal-social behavior is concerned. The major activity is motor activity, and vacuums are constantly being filled with stereotyped, circular-repeat-reactions. Here is one infant, tired of hitching about, who sits in the middle of the floor with a rubber toy and sways back and forth for minutes at a time as though doing some incantation. Two or three children are standing, but not still; they are weaving back and forth with incessant rhythm, reminiscent of the head rolling of their supine days. This too is environmental stereotypy. Another child is transfixed in a bent-over stance, similar to that of a football center about to pass the ball. But the child is poised for inaction; he peers through his legs again for minutes at a time,—a bit of postural perseveration again. Other children are indulging in unwonted, persisting chewing movements, —a stereotypy of mandibular action.

To a discriminating observer there is only one child in the entire group who seems to be behaving really normally. He is a newcomer just arrived, for emergency reasons, from his natural family home, where he learned to speak. He is talking to one of his creeping colleagues, and offering him a toy, but there is no language response. In time the prattling visitor will also adopt the institutional silence.

There can be no doubt that institutional children are retarded in language development. Our portrayal has not been overdrawn, if it reveals the mechanisms and the circumstances which choke the growth of speech and muffle social interchange, with all its give and

take of humor, of echoing back, of repeating over and over again, of laughter, praise, of mock surprise, of dramatic play, and of expressed affection which are part and parcel of a baby-centered home. Lacking all these repercussions, the institutional child often acquires a somewhat impassive face, because his facial muscles have not been adequately animated by social behavior. His countenance becomes rigidly bland.

He is not so much oversensitive to strangers as he is socially stupid with respect to their advances. He has not had much training in the subtleties of social advance and retreat. Nor can he meet halfway the overtures of speech and gesture when they come from another child. He has learned to be indifferent to many of the activities of an institution, because most of them are not personally directed toward him. He over-generalizes his indifference and withdrawal. He may "act strange" with men, because he has seen so few of them. The father's touch has been deprived him. He has had both too much and too little privacy. So many of his spontaneous initiatives have been unobserved and unheeded, that they were virtually stillborn. Many will not be born at all,—why should they? Likewise he has often cried or tried to speak without being heeded. This has tended to dampen his speech development. He has been denied the conversations of bed time, meal time, and toilet time. His toilet training has been more or less futile because of the regimentation,—ten tots on as many toilets at the same time! His caretakers are clothed in uniforms; the uniformity of their clothes; the uniformity of his own, and the lack of opportunity to build up a sense of place and property have all conspired to blunt somewhat the edge of his ego, and to confine the margins of his growing personality.

It is not our desire to exaggerate this portrayal of institutional life; but to indicate how the environmental mechanisms operate to bring about the syndromes of retardation. We call them syndromes because they are constituted of more or less characteristic behavior symptoms. Some of the effects may be permanent, but an institutional environment does not create amentia, even when it seriously depresses the D.Q. It produces lags, and bogs down both initiative and expressiveness. But fortunately it does not destroy latent maturation. The behavior improves with improvement of environment.

We make one more qualification, which serves, in fact, to prove the rule. If a child has superior endowment with respect to initiative and drive, if he is not too sensitive, if he has energy and sufficient vitality of temperament, he may not show environmental retardation. He may indeed become the pet of the institution. But even then he will not altogether escape unscathed,—if he stays too long.

In conclusion we list the symptoms which appear in a variety of constellations in institutional syndromes. They are further illustrated by a few brief case sketches in the following chapter. The term institutional is used for descriptive convenience. It should be clearly stated that a faultily managed, over-sanitary family home, or a misguided domineering governess, may create a set of environmental circumstances which have the same psycho-dynamics as an institution, and which will produce the counterpart of an institutional syndrome.

Cumulative Symptoms of Environmental Retardation and Deflection

The following symptoms are exaggerated in children of inferior endowment and in children of passive and acquiescent personality type. The approximate ages at which the symptoms become defined are listed. The symptoms tend to persist and summate. The syndrome consequently becomes more complex and intensified as the child grows older.

	Approximate Age of Appearance
1. Diminished interest and reactivity	8–12 weeks
2. Reduced integration of overall behavior	8–12 weeks
3. Beginning retardation evidenced by disparity between exploitation in supine and in sitting situations	12–16 weeks
4. Excessive preoccupation with strange persons	12–16 weeks
5. General retardation (prone behavior relatively unaffected)	24–28 weeks
6. Blandness of facial expression	24–28 weeks
7. Impoverished initiative	24–28 weeks
8. Channelization and stereotypies of sensori-motor behavior	24–28 weeks
9. Ineptness in new social situations	44–48 weeks
10. Exaggerated resistance to new situations	48–52 weeks
11. Relative retardation in language behavior	12–15 months
12. Definite improvement with improvement of environment	

CLINICAL ASPECTS OF CHILD ADOPTION

The hazard of environmental retardation is especially serious for all infants who are born out of wedlock, or who for one reason or another are deprived of parental care. Many of them immediately become charges of the state. Such foster children face an uncertain future if they are too long maintained in a hospital, a maternity home, an institution, or a boarding home. Society has developed the practice of child adoption as one safeguard against the dangers of institutionalization. But the adoption of a young infant is itself a complicated undertaking which has its own hazards.

This at once raises a question: Does the physician have any professional responsibilities in protecting the standards and procedures of child adoption? Can he escape these responsibilities even if he would? He brings infants into the world, those born out of wedlock as well as those who need no adoption. He is regarded as something of a godfather to all children. The consequence is that he is frequently asked to find an infant for adoption, or conversely, he is asked to find a home for an infant who is abandoned or surrendered. These solicitations are likely to be highly charged with emotional tension. Sometimes they are surrounded with great secrecy; and heavy demands are made on the physician's judgment. If he offers advice, if he takes any action whatever, he should be aware of the best modern practices in child adoption.

Child adoption is a social measure, primarily designed to perpetuate the home and to safeguard the fundamental rights of the child. As a social institution it is only less significant than the rite of marriage. And probate law usually provides that the child in adoption shall be "as though born in wedlock."

§ 1. THE DEVELOPMENTAL DIAGNOSIS OF FOSTER CHILDREN

Every child adoption situation poses three questions:

(1) Is the child physically and mentally a suitable subject for adoption?

(2) Are the proposed foster parents financially, morally, and psychologically fit to care for this child?

(3) Are the natural parents of the child living? If living, why are they abandoning or surrendering the child?

So grave and complicated are these questions that the physician will hesitate to go too far in answering or in disregarding them. It is neither fair nor wise to expect him, in his own person, to assume the role of an expert in such an exacting field of child welfare. He should not be asked either to secure or to place a child in adoption.

Yet he has an essential contribution to make. His counsel and his knowledge are needed. His broad insight into human motives may assist in determining whether the proposed foster parents are emotionally fit to be entrusted with an adoptive child. But his chief function is to render a careful judgment as to the physical status and developmental outlook of any infant or child whose adoption is under consideration. Here developmental diagnosis takes on great social significance.

By proper exercise of diagnostic skill the physician can greatly reduce the risks and the miscarriages of child adoption. And it is well to recall here that few things in life can cause more intense suffering than a bungled adoption,—heartaches for the adult; irreparable injustice to the child, with developmental damage to his whole emotional life. On the other hand, every good adoption makes a rich addition to the sum of happiness.

The restrictions upon adoption should not be too severe, too rigid, too clumsy. The physician should think of adoption as a social resource which needs conservation. There are too many poor adoptions; not enough good ones; too many hasty ones; too many tardy ones because of procrastination which keeps the children for months and years in boarding homes and congregate institutions.

Modern practice safeguards adoption by demanding ample investigation and by providing a probationary period of at least one year in the adoptive home. Such a period should be waived only in

very rare instances. It is a trial period which works no hardship. It is a natural supplement to investigation. It enables the physician to make a recheck on his first developmental examination. It gives all the responsible parties a chance to correct any error that may have been made. It prevents impulsive errors by simply postponing the legal formalization of adoption. By such safeguards society is overcoming the too prevalent notion that adoption is simply a matter of placing an infant starving for love into the arms of parents yearning to bestow love.

Child adoption, therefore, requires the combined wisdom of physician, social worker, and judge. Adoption is not merely a legal proceeding. It is an act of social adjustment in which the court has a basic responsibility.

The report of the physician on the developmental status and outlook of the child is a very essential part of the whole investigation procedure. How essential is indicated by the following illustrations of what happens when baby adoptions are not adequately regulated by social and medical procedures:

(a) An illegitimate baby boy was handed over by a maternity home and taken in adoption. He proved to be a premature baby in need of special hospital care; he had to be returned. He also proved to have a serious cardiac lesion.

(b) A middle-aged woman feared divorce on account of her childlessness. She adopted a baby in order to hold the affection of her husband. Jealousies arose instead. The home broke up. A child who should have had a good home lost out.

(c) An unmarried mother gave her child to an adoptive father who was so alcoholic that the child again became the ward of the state when 5 years old.

(d) A grandmother was given the illegitimate child of her daughter. It so happened that the grandmother was on parole from a state hospital for the insane and had to be returned to the hospital six weeks after the adoption. Relatives are sometimes the worst possible foster parents.

(e) An eccentric woman received an adoptive child but found she could not make him over; she tired of the experiment and rejected him.

(f) A midwife with great secrecy arranged to hand over a newborn baby to an Italian couple who eagerly wished to rush adoption through at once. A doctor who heard of the plans insisted on delay. In two weeks

the negro paternity of the infant became obvious. Haste can be costly; reasonable delay never harms.

(g) An unmarried woman gave her 2-day-old infant in adoption. He proved to be feebleminded. The best adoptive home in the world cannot cure amentia nor even overcome constitutional dullness in a child.

To the foregoing cases let us add one more. An Italian woman of excellent type had taken a 9 months old baby into her home. She lavished affection upon him. For a baby he looked quite normal, smiled, held up his head, and apparently paid attention to his surroundings. But our examination showed that he was definitely feebleminded in spite of appearances. At 12 months he had the mentality of a 6 months old child. We advised the agency against adoption; but something went amiss. A decree of adoption was granted. When the baby was 2 years old we saw him again. He was still a lap baby; he now had the mentality of a 1 year old child. He was beautifully dressed in white, lace-trimmed clothes. His mother still beamed upon him with a loving smile. She did not yet realize what had happened to her. We could not but feel that somehow she had been cheated.

To what extent the hereditary background of a foster infant should be taken into account is an extremely complex issue which often must remain unsolved. The paternity of the child is in a great many instances altogether unknown. Mental deficiency or inferior endowment in the mother is not an unqualified contra-indication to adoption. The mental deficiency may have been acquired rather than inborn; and even if primary it is not necessarily transmitted to the offspring in question. The child may well be definitely normal so far as his own mentality is concerned; although it must be granted that he may be a carrier of a defect which might reappear in the next succeeding generation. There is some risk in all adoption; as indeed there is in the bearing of one's own children. Candor requires that significant background factors should be known by the adoptive parents, but when the nature of these factors is duly interpreted, the parents should be ready to take a normal risk. If there is more than one instance of feeblemindedness, or of psychosis in the immediate family, this should act as a deterrent.   Every case

needs study on its own merits. In rare instances foster parents are ready to adopt a handicapped child with full cognizance.

On the other hand, some parents will insist, at times too strenuously, on a child of sufficient promise to insure college educability. Over-precise specifications are not legitimate in infant adoption. Superior endowment can often be detected in the first two years of life; but if the parents demand great certainty they should generally be advised to adopt a child over 4 years of age.

Other things equal, a child of superior intelligence should be placed in a home with intellectual interests and educational advantages. A child of inferior endowment in such a home may be seriously misplaced. The objective must be to avoid both over-placement and under-placement; but the emphasis should always be on psychological rather than on material factors. The economic status of a home is of less importance than the parental attitudes and the wholesomeness of the parent-child relationship. Similar considerations also hold true in the disposition of dependent and neglected children in boarding homes. Through physical examinations and developmental diagnosis the physician plays an important part in the placement of all foster infants, whether in boarding homes or adoptive homes.

His responsibility in the regulation of infant adoption is particularly important. He will naturally discourage all under-cover, bootleg adoptions; and frown on the commercialized practices of those adoption agencies and maternity homes which operate on a profit basis. And he will not let himself be drawn into blind and privately arranged adoptions even when they are undertaken in friendly good faith. They are wrong in method. The risk is too great. Sound procedure implies investigation of both sides of the adoption equation before placement, and a mandatory period of probation after placement. A careful developmental diagnosis of status and outlook is essential to these basic safeguards.

§ 2. The Growth Careers of Institutional and Adopted Infants

The function and significance of the developmental diagnosis of foster children can be best illustrated by a few actual cases. The following brief sketches will also indicate how the symptoms of

environmental retardation enter into the clinical control of infant adoptions. With one exception the cases selected are representative rather than exceptional. They exemplify the types of problems which arise both in connection with child adoption and in the supervision of young children placed in foster homes. The best practice and accepted standards of child welfare now require that all dependent children should be under responsible medical supervision at least while they are charges of the community. Such supervision will naturally include at critical points, the diagnosis of developmental status.

Seven cases are presented in order as follows:

(1) Institutional retardation followed by prompt recovery, justifying recommendation for adoption.

(2) Prolonged institutionalization, with slower recovery in a foster home, followed by placement in an adoptive home.

(3) Adoption postponed because of the effect of poor home conditions.

(4) Successful adjustment both to a faulty home and to an institution.

(5) Symptomatic institutional retardation in a defective child.

(6) Extreme symptomatic retardation from multiple causes, with temporary simulation of amentia.

(7) Prompt adoption of a normal child in early infancy.

Case 1. Normal infant; symptomatic institutional retardation.
Placed in foster home at 28 weeks; adoptable at 52 weeks .

This child was born out of wedlock. The mother was a young woman with a high school education. Birth was normal; physical development satisfactory. The infant was reared in an institutional baby home. At the age of *24 weeks* she was referred for a developmental examination. The agency had planned to give her in adoption if she passed muster.

She was a rather attractive infant with fairly well-defined emotional reactivity, who made a good general adjustment to the examination. Her performance, however, showed a wide range of scatter from 12 to 20 weeks, suggesting poor integration as well as retarda-

tion. There was a remarkable disparity between the level of her supine behavior and that of her sitting behavior.

Supine, she closed in on the rattle promptly and engaged in rattle play. She turned responsively to the ringing of the bell. Seated, she did not regard either cube or pellet, and gave only passive regard to the cup. She gave immediate attention to the examiner's incoming and outgoing hand. These attentional patterns were at a 12 weeks level; but the history of institutionalization and certain normal features in the behavior picture restrained a diagnosis of amentia. A qualified favorable prognosis was made.

Immediate placement in a boarding home, rather than an adoption home, was recommended to determine the effect of a family environment. At the age of 28 weeks she was placed as a boarder with a foster mother who had three children of her own, ages 7, 10, and 15. These three children took great interest in the infant newcomer who was returned for re-examination at the age of *40 weeks.*

This examination showed a marked improvement in the behavior picture. Much of the previous scatter had disappeared. The behavior was now well integrated at a maturity level of 36 weeks. The baby was healthy and happy. The prognosis now was favorable, but the twelve weeks in the foster home had been so beneficial that another twelve weeks in the same temporary home was recommended.

Accordingly this infant was re-examined at the age of *1 year.* Again she made a good adjustment to the examination. She rated at a full average level, and was forthwith considered a suitable candidate for adoption. Immediate placement in an adoption home was recommended.

In spite of a favorable personality make-up, this child showed symptomatic retardation as a result of six months of life in an institution. Six months in a family home was a therapeutic test which demonstrated her essential normality. She was definitely adoptable at the age of 1 year. Had she been referred for examination yet earlier in infancy she might have been placed in adoption at a much younger age, to the advantage of all concerned. Had she never been subjected to institutional life, the symptomatic retardation would never have figured as a diagnostic problem.

Case 2. Prolonged institutionalization, with symptomatic retardation.
Boarding home placement prior to adoption necessary

This was a small, dainty infant, who at the time of the first developmental examination, at the age of *17 weeks*, was socially responsive and made a favorable clinical impression.

She was born out of wedlock; birth weight 6 lbs. 4 oz., with a possible prematurity of 6 or 8 weeks. The birth history was normal. The child was reared in an institutional baby home; was surrendered by the mother and made available for adoption. Our report to the child welfare agency outlined the implications of our findings with respect to adoption:

At *17 weeks* this is an alert infant who adjusted well to the examination. Head control is poor and she is barely able to lift the head in the prone position. She gives prompt attention to toys and makes some prehensory effort. She contacts the cubes and grasps the rattle when it is close to her head. She regards the rattle in her hand and also engages in hand regard. She smiles, is reported to laugh, and selectively regards the examiner and observers.

Her general maturity level is approximately 16 weeks, with gross motor behavior near 8 weeks. In view of her alleged prematurity we consider her development satisfactory. We should like to make at least one more examination before recommending placement in adoption, and because the prospect of adoptability is so favorable, we urge prompt boarding home placement. Delay in home placement will mean prolonged institutionalization and continued deferring of a final adoption recommendation. Prompt home placement, it is hoped, will result in an equally favorable behavior picture at 24 weeks, when she could be recommended for adoption without further delay.

Our recommendation was not carried out for a variety of those reasons which so frequently conspire against a child deprived of parental care. Indeed, this child remained in her institutional home until the age of 15 months.

Examination at *24 weeks* yielded evidence of environmental retardation. Performance was at a 16 to 20 weeks level. There was delayed, feeble regard for the cube on the table top; there was excessive distractibility of attention to her own hand and to the ex-

aminer's hand. There was excessive regard for the examiner, typical of the institutional syndrome.

At *40 weeks* the syndrome had developed additional characteristic features. She made a poor adjustment to the examiner, with alternating, half-smiling, half-fussing and over-fascinated regard. Placed in the crib she rocked habitually.

At the age of 15 months she was finally placed in a boarding home, where she had an opportunity to play with other children and to find a secure place for herself in the affections of the family. After a period of shyness and withdrawal she made a good adjustment to the children and to the dog (hitherto she had not seen a dog!).

Examination at *18 months* showed the effects of family home life. Her behavior rated near the expected level, and placement in an adoptive home was recommended and promptly carried out.

At *21 months* she gave a high average performance on the developmental schedules. The mutual acceptance of child and home was a thoroughly happy one. Continuation in this home with a view to ultimate adoption at the end of a probationary period of one year was recommended.

Legal adoption was consummated at the age of 2½ years. Because of favorable personality factors this child was apparently not handicapped by her prolonged institutional experience. Under slightly different arrangements this child might have been safely placed in adoption in early infancy, obviating the intermediate placement in a boarding home, made necessary for therapeutic and observational purposes. There was no defensible reason for the extremely lengthened residence in the institution.

Case 3. Symptomatic retardation and deviation in a faulty family home. Readjustment leading to a favorable adoption

This illegitimate child has had a chequered career. After a short period in an institution he was placed in foster home A. Misguided management combined with his sensitive disposition caused development to take on a blind alley character. He developed atypical forms of behavior during the first year. He acquired many behavior mannerisms. At the age of *48 weeks* his manipulation of toys consisted of a peculiarly limited patting with the palm or tapping with the index finger. In a similar way he tapped his lip and chin

with his thumb. He showed serious retardation on developmental examination; but the behavior picture was so suggestive of environmental factors that the prognosis was qualified. Although the foster parents were anxious to adopt, we advised that the infant spend six months in foster home B, while measures were taken to reorganize the mode of living in foster home A.

This therapeutic test proved very productive. Re-examination at *56 weeks* of age showed considerable integration of behavior with disappearance of most of the mannerisms; retardation was still present.

Re-examination at the age of *18 months*, after seven months in foster home B, showed further improvement. The boy was now normally assertive and emotionally more hardy. His maturity level at approximately 15 months indicated some retardation, but the quality of the behavior suggested potential normal development so strongly that return to his original foster home A was approved.

This restoration had fortunate results. With guidance the foster mother acquired a better understanding of the child's emotional needs and she greatly improved her methods of care. Even though 18 months is not the most favorable age for an adoptive placement, this boy made a good readjustment. At the age of *30 months* developmental examination indicated a full average level of maturity, with attractive personality traits. Adoption was consummated happily for all concerned.

In this case the combination of a sensitive child and faulty management produced symptoms similar to those which arise under distorting institutional conditions. An aggravated behavior problem might have been induced and adoption seriously prejudiced if this situation had been allowed to drift. Careful diagnosis and parent guidance by the physician, plus a therapeutic trial, replacement in new surroundings, plus the assistance of a social agency, served to safeguard the normal potentialities of the child.

Case 4. Normal infant with vital personality traits.
Adverse home and institutional conditions ·

This was a small, wiry, button-eyed infant. She had four siblings, an affectionate father, but a psychotic mother. The children were severely neglected, untrained, cruelly treated at times, and under-

nourished. She spent seven months in this deleterious home environment and five subsequent months in a child caring institution.

Developmental examination at the age of *12 months* gave no evidence of environmental retardation or deviation. Her performance was consistently and coherently at an average level. Blessed or born with an extraordinarily friendly and outgoing disposition, she had withstood the buffets of her natural home and become a favorite in the institution. Indeed she was the pet.

Environment is an empty abstraction for clinical purposes unless reduced to concrete terms which define the actual factors at work and take into account the susceptibilities and immunities of the organism. The poor home had compensating features, and the native vigor of the child's personality traits withstood depressing effects. In the institution these same traits bent the environment to her own advantage. The institutional environment did not deflect her; she deflected its forces so that they converged favorably upon herself.

Case 5. Environmental retardation in primary amentia.

This infant was born out of wedlock and spent all of her first year in an institution. At the age of *6 weeks* she was small and scrawny, but apparently alert and visually perceptive. She made a relatively normal impression.

At the age of *24 weeks*, however, she presented an atypical behavior picture. She made an undiscriminating adjustment to the examination, and laughed in an automatic manner each time she saw the examiner. She did not perceive or exploit objects on the test table, but when supine engaged in regardful rattle play,—a disparity of performance frequently associated with institutional retardation.

Re-examined at the age of *52 weeks*, the behavior proved to be seriously deviated and defective. Our clinical notes describe her as a "wistful waif with dead pan expression." Animation was detectible only at rare and brief moments; for example, when she was lifted to a supported standing position. She responded to the translation with a faint smile and a fleeting chuckle. The only vocalizations heard were soft clicking and sucking noises made with closed lips.

She was content to sit alone for indefinite periods, staring abstractedly and rocking intermittently. Nevertheless it was possible

to divert her attention momentarily to the pellet and bottle. Exploitation was confined to aimless pushing, poking, and tapping. Rarely did she grasp an object; she tended to release propulsively before completing the grasp. If grasp was effected, it was maintained briefly with no increase of interest. Visual regard for test objects was highly variable, it might be delayed, precipitate, prolonged, fleeting, or lacking altogether. Yet there were no signs of neurological impairment.

There were snatches of exploitive behavior consonant with a 40 weeks level of maturity, but the functional organization of eye and hand were scarcely at a 16 weeks level. The behavior was at least extremely defectively integrated.

Were we dealing with mental deficiency or with symptomatic deviation and environmental retardation? Hypertelorism was present, and was counted as a developmental anomaly of unfavorable import. Diagnosis was suspended pending a therapeutic test.

Re-examination was made at the age of *18 months,* after a period of five months in a foster home where she received intensive individual attention. It took her two weeks to adjust to her new home which she then accepted completely. She is now (at the age of 18 months) the same solemn-faced eerie child. She still creeps (as she did at one year), but can walk a few steps. Her adaptive behavior does not rise above the 40 weeks level, and then only in a fitful, fragmentary way. Her foster home experience has redirected the patterning of behavior into more conventional forms and she now exploits toys more fully but still at an infantile level. In the absence of toys she reverts to table scratching and atypical fingering movements—manifestly a cauliflowered stereotypy. She articulates no words, but is said to imitate an "oh" sound. The attentional patterns remain bizarre and non sequitur, punctuated with frequent periods of abstractness and episodes of primitive hand play. The improvement under foster home conditions has been specious rather than fundamental. The therapeutic test does not need to be prolonged. The behavior is so defective that adoption is contra-indicated.

On retrospective analysis this case proves to be misleading rather than complicated; confusing rather than involved. It is atypical and yet it presents, in somewhat paradoxical combination, symptoms which are typical of environmental retardation, and pseudo-sympto-

matic retardation (which is genuine amentia). The case does not so much need differential diagnosis as multiple diagnosis. If in the interest of open mindedness we entertain the possibility of psychogenic depression, the case wears the plausible but false aspect of purely derivative or symptomatic retardation. But the total evidence points conclusively to a genuine amentia,—to an intrinsically deficient behavior equipment, incapable of organic patterns of attention, and retarded even in the attainment of imperfect patterns. The patterns, however, undergo palpable improvement in a non-institutional environment; the over-individuation loses some of its excesses.

We are left then with the simple but not amazing conclusion that a mentally deficient child can suffer environmental retardation and deviation. Indeed, the tendency toward over-individuation in an infant ament under institutional restrictiveness exaggerates the misleading syndrome which has been discussed in Chapter VII under the heading of pseudo-symptomatic retardation. The differential diagnosis is amentia; the super-added diagnosis is environmental retardation and deviation.

Case 6. Extreme symptomatic retardation. Delayed recovery and ultimate adoption

This case is highly exceptional rather than typical, but is nevertheless instructive. It is distinguished for the sheer number and complexity of the complications which conspired to retard the course of early development, without, however, permanently impairing the latent normality. These various developmental factors are included in the following tabulation:

(1) Premature birth (out of wedlock)

(2) Hereditary syphilis with a 4 plus Wassermann reaction in mother and child (followed by treatment)

(3) Breech delivery, hyperactive reflexes and slight spasticity, suggesting minimal cerebral injury

(4) Microcephaly? (x-ray report)

(5) Prolonged feeding difficulties

(6) Severe upper respiratory infection, associated with acute suppurative otitis media, diarrhea, stomatitis, gingivitis, hemorrhagic nephritis

(7) Isolation in hospital for twelve weeks

(8) Institutional life for fifteen months

(9) Foster home for twenty months

(10) Adoptive home at the age of 34 months

The first developmental examination of this child was made at the age of *42 weeks* while she was still in a hospital, having just recovered from her severe illness. A serious degree of retardation was evident, even making age allowances for prematurity. The general maturity level was at 20 weeks. She sat only momentarily with active balance. She regarded her own hands intently at the test table; scratched the surface; made poor and only occasionally successful prehensory approach on test objects. Both postural and adaptive behavior were so retarded that the behavior picture was considered defective, with a prognosis of possible improvement in a non-institutional environment.

At the age of *65 weeks*, however, she was still in an institution. The retardation remained severe. The infant was now able to pull herself to a standing position and to cruise holding the crib rail,—her best performance at a 44 weeks level. But her exploitation of test objects was extremely meager and devoid of combining. Adaptive, language, and personal-social behavior rated scarcely above a 24 weeks level.

Mental deficiency was strongly suggested by this behavior picture; but at the age of *2 years*, after nine months in a foster home, she showed considerable improvement. Her attention was more adaptive; she built a tower of 3 cubes; she scribbled vigorously; she placed a round block in the formboard; she had a vocabulary of 7 words; she verbalized her toilet needs. Her performance had risen to an 18 months maturity level,—a developmental increment of 12 months in 9 months of chronologic time, denoting a compensatory acceleration. Further improvement was predicted.

At the age of *3 years*, soon after placement in what was to be her adoptive home, the general maturity level had risen to 30 months.

At the age of *4 years* she was an alert, attractive child, reaching almost a complete average performance on the developmental schedules,—a remarkable realization of latent normality which had been impeded and deflected by numerous factors, both intrinsic and extrinsic. She was now in every sense adoptable.

No single feature of this case is exceptional; but the contemporaneousness, the cumulativeness, and the interaction of all the developmental hindrances depressed the level of behavior output to an extraordinary degree. It is indeed the most extreme case in our files. In retrospect it appears that the number and obviousness of the secondary factors served to conceal what was probably the most determining factor of all, namely a mild, slowly resolving cerebral injury. The transition from thirty weeks of institutionalization, to twelve weeks of hospital isolation, to twenty-three more weeks of institution, exacerbated the depressive environmental effects. On the first examination, note was made that this infant was pathetically eager for attention. This item now takes on new meaning.

The total growth career suggests the validity of the concept of reserve factors, locked in the inner recesses of the organism, beyond immediate diagnostic scrutiny. These factors are most vigorous and abundant in the most vital and best endowed individuals. They may come to the rescue when development is threatened or obstructed by hindrances such as were operating in this case. As a poison stimulates the formation of antibodies, so certain deviations or depressions of development stimulate a regulatory self-correction,—*if the individual is adequately endowed,* as was happily true in the present instance.

Case 7. Prompt adoption of a normal child in early infancy

To paraphrase an old adage, blessed is the child whose developmental annals are brief. No extended tabulation of complications is necessary for this child who, like so many adopted children, was born out of wedlock. Her birth and neonatal history was normal. From the hospital she was immediately placed in a boarding foster home.

A developmental examination at *8 weeks* of age showed normal behavior maturity. She was a healthy, attractive, well-cared-for infant, who made such a decisively good showing on the developmental schedules that direct placement in an adoptive home was recommended on the basis of this single and early examination.

The behavior picture was well up to full normal expectation on subsequent examinations, at *16 weeks* and at *40 weeks*. She had been well placed and adoption was in due time consummated.

Early examination and other favoring circumstances permitted early adoption, which has many advantages when adequately safeguarded. If there had been any significant complication in the medical history, or any evidence of even minimal cerebral injury, prompt placement in an adoptive home would have been inadvisable.

In making adoption recommendations, chief weight should be placed on the developmental examination; but, to repeat, the probationary period of one year should be insisted upon, to make possible the correction of any errors made by court, agency, foster parents, or physician.

§ 3. THE PHYSICIAN'S RESPONSIBILITY

There is a postwar boom in child adoptions. Broken homes are on the increase, illegitimate births are on the increase; childless homes and child rejections are multiplying. As a result the rate of baby adoptions has trebled in recent years; and the medical profession has become involved to a serious degree. In the face of such a grave social situation, the role of the doctor needs to be reexamined and his responsibility defined.

First and foremost he should throw the weight of his authority behind officially accredited agencies, empowered by law to investigate, to supervise, and to protect the status of the child during a probationary period of one year. Stated negatively, the doctor should not, in his own person either as friend or as physician, undertake to initiate and to sponsor an adoption. It should, indeed, be unlawful for anyone but a specifically licensed person to place a child in adoption.

Unfortunately only about one-fourth of the states have adequate adoption laws; and in actual practice about three-fourths of all cases of adoption are privately arranged. Under such circumstances it is easy for a misguided, though well meaning, physician to assume too much responsibility. Adoption is a statutory proceeding, and essentially he should be an agent of a court of petition, investigation, and decree. His professional function is to appraise, on physical and developmental evidence, the adoptability of the child in question. He can also contribute to an appraisal of the motives of the adoptive parents. He may be subjected to uninvited pressures,

emotional and otherwise, by desperate relatives, friends, lawyers. On such occasions the hazards of blind, privately arranged adoptions become so great, that wise counsel on the part of the physician will have far reaching influence.

By sheer good luck not a few blind private adoptions turn out happily. But all private adoptions are wrong in method and in principle. Commercial adoptions, even when thinly veiled with respectability, are worse, because they become rackets or transactions of the market place. Undercover, bootleg adoptions are still worse. They are an affront to the State and a violation of the dignity of the human individual.

Many babies offered for adoption are born out of wedlock. Half of their mothers are under twenty years of age. This increases the risk of impulsive, private adoption. The anonymity of the child is not sufficiently safeguarded, and his mother may make a repentant or mendacious claim after he has been safely (?) placed. The child's rights of inheritance may be jeopardized.

Moreover, the developmental outlook of children born out of wedlock is by no means uniformly good. In our clinical experience, out of a dozen children thus born, perhaps two children remain with the mother's kin, one or two may be definitely defective and unadoptable, four may be inferior, dull, unstable with deterrent personality or hereditary factors. Four, however, may be of average promise and adoptable; one may even be superior. These proportions show trends which will, of course, vary with different populations. The trends however, point authentically to the potential risks and miscarriages of early adoptions.

When, therefore, the doctor is asked "Is it safe to adopt an infant?" he may well counter by asking "Safe for whom?"

It is safe for the *infant* if the motives, attitudes, and expectations of the adoptive parents are healthy and reasonable.

It is safe for the *parents* if the baby is well constituted and conceals no defect or blemish which would disappoint their reasonable expectations.

It is safe for *society* if the adoption has been undertaken and consummated in a realistic, planful manner, which safeguards simultaneously the welfare of the child and of all the parents concerned (the total number being three or four).

The fact that three out of four adoptions in America are nevertheless blind and private, has led to paradoxical consequences:

(1) Adoption demand is far in excess of supply. Yet there are not enough good adoptions.

(2) There are too many poor adoptions.

(3) There are too many non-adoptions which could be converted into satisfying, successful adoptions.

(4) There are too many impulsive early adoptions.

(5) There are too many deferred adoptions which might have been made early.

The whole procedure and philosophy of child adoption have suffered from misplaced sentiment and misplaced publicity. We need a more realistic and democratic approach to the neglected areas of this vast problem, including the large numbers of unadopted infants and preschool children who are lost to sight, because society has not organized adequate provisions for their identification through social service and developmental diagnosis.

PART THREE

THE PROTECTION OF EARLY CHILD DEVELOPMENT

XIX. Diagnosis and Guidance
XX. Developmental Pediatrics

CHAPTER XIX

DIAGNOSIS AND GUIDANCE

§ 1. INTRODUCTION

In child development, diagnosis involves prognosis and prognosis involves guidance. The three are interdependent. And since development is a continuing process even for defective and handicapped children, physician and parents must enter into a kind of partnership to keep pace with the behavior changes as they occur, or as they may fail to occur. Developmental guidance is an interpretation of the behavior characteristics of infant or child, in terms of growth, maturity, and social environment. Its very foundation therefore is adequate developmental diagnosis. There are no absolutes in the task of parent-child guidance. The problems of care and management must all be reduced to the relativities of age and development. These relativities apply with equal force to defective, deviate, handicapped, and normal children.

It is in the early years of life that all types of physically and mentally handicapped children are most in danger of being neglected. The first three years are of special importance both for identifying these children and for initiating adequate medical and educational measures in their behalf. The temptation is to wait until the handicapped child gets to be of school age. There is a vague optimism that he will outgrow his handicap, or there is actual resistance to acknowledgment of the handicap. Surprisingly often the handicap is not even noticed. The result is that the first formative years are educationally lost. Sometimes the child is actually misunderstood and unwittingly mistreated. Both he and the parents make a false start when it is supremely important to get a right start.

No one is in a better position than the family physician to set

things going right. He has the first opportunity to detect the handicap, to estimate its seriousness, and to bring about constructive attitudes in the family circle. He may not do all of this in one session. He may impart and elaborate his diagnosis by progressive stages. Soon he takes up the practical details of advisory guidance, the details of every-day care, of management at home, of planning for hospital, institutional or school care. It is not assumed that the physician will make himself responsible for all of these details. The care of a handicapped child often proves to be a complicated problem which requires the co-operation of social worker, public health nurse, visiting teacher, home visitors, community agencies, including state and even federal agencies. The physician can bring the community resources to the attention of the family. If he is not acquainted with them he may have to make inquiries of the proper state department or seek help from the Children's Bureau in Washington. But none of these public agencies has census takers who go about discovering who and where the handicapped children are. That is still the prerogative of the family physician and of the physician attached to hospital and institution. He must identify the individual cases and initiate the individual programs of treatment, of physical care, and of psychological care.

Now it is true that community resources and facilities are set up chiefly to take care of handicapped children of school-going age. But that is all the greater reason why the physician in his strategic authority should initiate and so far as possible devise a special program which will insure the maximum developmental protection during the fundamental and formative first years.

Much can be done by sheer planning if the right help is enlisted. The young practitioner is well advised who makes himself concretely acquainted with the schools, including nursery schools, and with the private and public child welfare agencies in his community. First hand acquaintance with the work and the workers will direct and strengthen the developmental guidance for which he is responsible.

§ 2. Imparting a Diagnosis

A diagnosis must not only be made, it must be imparted. And the imparting may take quite as much skill as the making of the diag-

nosis. This is particularly true of those cases in which a grave developmental defect brings with it the deepest frustration and disappointment which can occur in family life. The poignancy of this frustration needs no description; it is the very negation of the high expectations which normally center about the life of a child. No one can properly impart a grave diagnosis who does not sense the depth and imagine the nature of the sorrow involved.

Inasmuch as this section is addressed mainly to medical students who have not had much experience in these matters, we shall first of all briefly indicate how *not* to impart a diagnosis of mental deficiency. Do not dismiss the case bluntly by calling it incurable. Do not use point-blank clinical terms such as imbetile, idiot, moron, or feebleminded. The sensibilities of the parents need the utmost consideration. However, their sensibilities should not be spared with a sheer fiction, by false assurance that the child will outgrow the defect. Nor should parents be deceived by a placebo type of glandular treatment which nourishes false hope. All too frequently, parents, abetted by undue professional encouragement, cling for years to the faith that something can and will be done to make their defective child normal. This misplaced faith deepens and becomes an unhygienic method of escape from the realities of the situation. Thus a second mental problem is added to the first and that without in any way solving the first.

It is the physician's duty to help the parents to face reality as early and as steadily as possible. The precise manner in which the diagnosis is conveyed must be left to his tact and wisdom. The circumstances vary so greatly that no general rule can be laid down. By progressive stages if not by immediate approach the true facts must be imparted. The mental welfare of the family is more at stake than that of the child as an individual. The problem should not be handled in terms of the child alone.

The child is the patient, but the problem is peculiarly a family problem which may involve brothers and sisters, and almost always concerns the mental hygiene of father and mother. In many instances the consequences of mental defect or abnormality go so far beyond the child that they injure normal marital relationships. One parent may blame the other, or both parents may harbor an altogether unwarranted sense of guilt. Sometimes the emotions are projected

against a hospital or a physician, with paranoid intensity. For reasons such as these every case of mental deficiency and of cerebral injury constitutes a challenge to the highest type of medical service even though the condition itself is beyond cure.

Before communicating a final diagnosis it is advisable to ask the parents what they themselves think of the child's condition. This will reveal their attitudes and their misconceptions. The very words they use in framing the reply furnish the doctor with the words which he can use in imparting and interpreting the diagnosis.

The resistance of parents to an adverse diagnosis is natural; but in the end they do not wish to be deceived and they will resent the inconclusiveness of long delay. Ambiguous assurances and fostered optimism lead to expensive shopping around. Parents should be distinctly advised against such wastefulness. When, after a long period of futile hopefulness, a frank diagnosis is finally imparted, the mother, no matter how badly she feels, reacts with grateful relief: "If I had only been told this in this way years ago!"

There is no advantage in waiting for an auspicious time to spring a diagnosis. There is no good time, and parents generally are able to show an innate capacity to confront reality if they are properly approached. And there is no advantage in waiting for the child to grow up. Infancy remains the best time for imparting a diagnosis of mental defect. When the physician has made a decisive diagnosis it is his duty to tell the parents without delay.

In less clear cut cases where he suspects serious retardation but has not made a conclusive diagnosis, he can tactfully convey part of his suspicion. A gradual approach has its advantages. The hint of suspicion is like the planting of a seed, and since it is a well founded hint, it prepares the way for a fuller diagnosis as time goes on. The examiner neither reassures nor alarms but says, "Come back in another month. I want to see how much he develops in that time." The cumulative evidence of two or three comparative appraisals helps to bring about acceptance of the diagnosis. The parents have begun to watch and to see for themselves.

Such a progressive approach also finally leads to a concrete discussion of prognosis. The time soon comes when the parents must realistically consider what the future holds in store. Here again candor is much the better policy. It need not be ruthless but it

should be so revealing to the parents that they will understand what kind of training, supervision, safeguards, and institutional provisions will be necessary when the child grows older. Searching questions will be put by the parents: Will he ever walk? When will he talk? Will I always have to take care of him? Won't he ever go to school? Will he be able to earn his own living?

The questions cannot be brushed aside. They are irrepressible questions. Medical service consists in meeting them intelligently and in a helpful manner. Parents need orientation. No one is in a more authoritative position to guide them than the physician. Parents and physician must work out the problem together.

§ 3. DEFECTIVE CHILDREN

In the case of deficiency, guidance takes its point of departure from the child's developmental age. In imparting the diagnosis great care is taken to avoid any drastic clinical label. Descriptive characterization makes it quite unnecessary to designate a child as an idiot, imbecile, or moron. It is wiser to say in effect, "Your child is backward; he is growing slowly; he will continue to gain some more, but he will gain more slowly than children of his age." Such a statement puts the whole matter on a relative basis. Parents must learn to think of the child in terms of his developmental age, in terms of his true capacity, rather than their expectations. Parents who reject a valid diagnosis exacerbate their misfortune by overestimating the child's abilities, and by misguided efforts at training him beyond what his level will bear. The defective child on the other hand shows his resistance by so-called stubbornness. Nothing is so beneficial to parent and child alike as a philosophical acceptance of the maturity age, which cannot be transcended even in a normal child and much less in a defective one.

When the personality characteristics of the mentally deficient child are favorably constituted, as often is true in mongolism and other amenable types, parents can learn to take an adjusted kind of satisfaction in the child's accomplishments from year to year. But this can be done only if the child's chronological age is valiantly ignored and if he is considered on his limited developmental merits.

Although mental deficiency cannot be cured, nearly all but the severest cases respond in some measure to training and good man-

agement. There are numerous cases for whom a program can be worked out in the home and community. Institutional commitment should not be recommended too abruptly, nor taken as a matter of course. Often it is advisable to have the child spend his early years under the home roof.

If institutional care is indicated but resisted, it is wise to remotely suggest such care by way of advance preparation long before the parents are ready to take the required steps. In time the positive benefits of institutional life can be frankly stressed. The stigma of the term institution should be removed by emphasizing its medical and educational advantages. But parents should not be over-persuaded. The decision must come from them. If both parents are living, both should participate in the decision, and both should be in the doctor's presence when commitment papers are signed. This is especially important when the mother out of her instinctive protectiveness finally makes the decision in behalf of the child; while the father out of strenuous pride and determination remains unconvinced, and believes the child will somehow yet make good. In our experience, fathers show this intense type of resistance more often than do mothers. Indeed, there may be repressed or open conflict between mother and father with respect to their opinions of the child's deficiency and the cause of its origin. The conflict can reach psychiatric intensity, which is another reminder that the problem of the defective child ramifies into the whole family situation.

Brothers and sisters also need to be considered. It is often literally impossible for a mother to give her defective child proper care without neglecting her normal children. She may even develop the philosophy that they can take care of themselves or that the spiritual discipline will be good for them. The very presence of a defective child in the home, however, may demand adjustments that a normal child should not be asked to make. The situation is hard enough for adults; for children it may be unbearable. The physician should help to restrain the parents from sacrificing themselves or their normal children for the sole purpose of keeping an ament at home.

The recommendation of institutional commitment should be made with firmness if the mother's physical and mental health is endangered, as it often is when she battles too long against recognition of the permanency of the mental defect. Sometimes the sheer in-

creasing weight of the child creates an impossible situation. She can no longer carry the child around! Or he is physically too strong for management. The prospect of such a situation should enter into the physician's perspective long before it is realized by the parents.

When a special class for retarded children in a public school is available, the physician can be of great assistance in endorsing the beneficial influence of such special educational provisions. When neither institution nor special class is available, it is well to contrive substitute and supplementary arrangements. A well selected boarding home with periodic supervision on the part of the physician will prove a satisfactory solution in many cases. When economic conditions make this impossible, some auxiliary help should be provided. Even two hours a day or two afternoons a week of such assistance from a caretaker may forestall a breakdown on the part of a mother who is trying to carry an impossible burden.

A special summer vacation arrangement may also be advised with great benefit in many instances. Such an arrangement takes the child out of the home for a period of several weeks; it may have beneficial effects for the child; it gives the mother an opportunity to correct her perspectives. The temporary detachment may become the first step toward the more permanent detachment necessary for institutional commitment. Common sense measures of this type may prove of great value in the management of a perplexing situation, and they are only too often overlooked.

As already suggested it is up to the physician to initiate individual programs for the defective and handicapped children under his supervision. The tendency in the medical care of the feebleminded is to dismiss the case with a diagnosis. Diagnosis is only the beginning. Even though the condition is incurable it needs management, and the physician can render most important service through periodic contacts and conferences which will progressively build up an adequate philosophy in the parents and assist them in the detailed task of planning for their defective child. It must be recalled again that the health and mental welfare of these parents are heavily involved. The problem begins with the child; it does not end there.

Often the problem reaches into the uncertainties of the future and is projected to include children unborn:—"Can we take the risk of having another child?" No simple rules determine the answer to

this question. Each case must be considered on its own antecedents. In some instances there is no risk whatsoever, and the confident assurances of the physician play an important part in bringing about a satisfactory adjustment. In cases of mongolism there is virtually no risk. If the ancestral history shows only one indication of neuropathic inheritance, the risk nevertheless may be small. If there are multiple indications, or if there is evidence of defective inheritance in both family strains, this should be considered a deterrent. But every case must be considered on its individual merits. On the basis of scant evidence one is not justified in making dire predictions as to later progeny.

Infants and young children of borderline mentality often present a mixture of retardation, immaturity, and emotional instability. They must be treated with great patience, and with moderated optimism. Their behavior tends to improve with age, if life is not further complicated for them by over-strenuous and mistaken methods of management. There is danger in trying to do too much, too early. It is better to endure shortcomings which are due to insurmountable growth factors. The behavior difficulties may take on a neurotic or psychiatric aspect, even though they are more truly explained on the grounds of faulty original equipment and of developmental inferiority. Intrinsic developmental mechanisms rather than dynamic psychogenic factors are at work.

§ 4. HANDICAPPED CHILDREN

The importance of understanding the psychology of the handicapped child was developed in detail in the discussion of the blind and the deaf. Each type of handicap creates its distinctive problems.

In the case of crippled children a discriminating understanding is of special importance, because their true capacities cannot be measured by their motor abilities. A child may have a very restricted paralysis and yet be mentally deficient to an extreme degree. He may have an extensive motor incapacity and yet be extremely intelligent and emotionally sensitive. When a competent neurological and orthopedic diagnosis has been defined, practical questions of treatment at once arise. Developmental examinations in infancy are necessary to determine whether a crippled child has sufficient

mentality and drive to justify a long and expensive program of treatment.

The first years of life are strategically the most important from the standpoint of diagnosis, treatment, and guidance. Prompt medical and surgical care in infancy is the first essential if the child is to develop to his optimal capacity. The crippled child is not a sick child, and he can be treated like a well child even in infancy. He must not be over-protected; he can be propped in the sitting position if he cannot sit alone; he can be taken out in a carriage; he should be given experiences.

The mother is entitled to feel that everything possible is being done to help the child; on the other hand she must be made to realize the limitations of physiotherapy. Even if the child acquires the ability to walk, he may still be crippled. Moreover he may never acquire walking at all. Yet he may greatly benefit from speech training. The ability to talk should be regarded as more important than the ability to walk.

However a premium should always be placed upon mobility, so that the child can enjoy a sense of personal power. He should be allowed to hitch, to roll, to creep, to use an infant walker. When he outgrows the walker a special homemade contrivance on wheels should be constructed, if necessary with the aid of the plumber.

Physiotherapy can begin in the first year, but is often wisely postponed until the second. The parents should be warned that any training program will require years of patience and will at best yield slow results. Since the value of treatment depends upon the co-operation of the child, resistances which he offers should be respected. The worker should not lose courage; the program can be relieved by vacation periods.

In all types of handicap, whether sensory or motor the parents should understand the nature of the handicap and the purpose of the training and treatment measures. They should not be led to expect too much in the way of results. Their questions should be answered and the realities of the situation made clear. They must be helped to accept their handicapped child for what he is and to build up the right attitude toward him. This attitude means acceptance of the child, a desire to help him, pride in his accomplishments. It does not permit over-protection or over-sympathy; it never lets

the child see the parents' disappointment; it meets the situation as a challenge.

§ 5. NORMAL CHILDREN

The major inclusive problem for all growing children whether defective, deviate, handicapped, or normal, is one and the same. It is the problem of development,—the problem of maturing, of organizing the behavior equipment with which they are endowed. And since development, in this biological sense, is an inescapable problem, it is entirely natural for many so-called normal children to encounter difficulties along the pathway to maturity. It is normal for normal children to present developmental problems.

Parents are entitled to some measure of guidance in managing these normal difficulties. At any rate intelligent and articulate parents are demanding such guidance. They are not satisfied with arbitrary and over-rigid prescriptions of regime. They would like to have special consideration of the individual developmental needs of their particular child, even though the child is normal.

To what extent can the medical practitioner meet these ever growing demands? He surely does not escape them. They confront him at every turn in connection with the supervision of the infant's nutrition and physical welfare. Should the baby go on a three or a four hour schedule, or on a self-regulatory schedule? Is he ready for solids at 12 weeks or should he wait till 20 or 24 weeks (for reasons of neuro-muscular maturity)? Should he be granted some self-selection in foods? What opportunities should he have for gross motor exercise, for social contacts, for play activities? There are questions about clothes, sleeping garments, sleeping arrangements, bath, toilet training, toys, weaning, self-feeding, finger sucking, crying, disobedience, etc., etc. Even an expert pediatrician would not claim to have all the answers, but he could scarcely deny that many of the questions come within the province of medical practice.

In most of these details of management, rule-of-thumb advice is of little practical value. It usually serves no good purpose to tell a mother exactly how she should do a thing. It is more important to tell her how to approach the problem and how to look at it. Even the most exact advice fits a case for a short time only. The child is

changing; so the problem changes. Parent and physician alike must recognize these ever changing developmental factors.

If individual development is ignored there will be too much reliance on general rules which do not fit the specific child. There will be a temptation to do too much through sheer training and discipline. In many aggravated and aggravating behavior situations it would be better to do nothing at all than to strenuously pursue a mistaken course. The infant would profit if we made a more deliberate effort to avoid doing the wrong thing, and to place more confidence in the natural self-corrective tendencies of inherent growth. In normal and potentially normal children, the growth process is equivalent to the healing process. Over-active intervention and drastic treatment may actually interfere with the optimal realization of this process. One cardinal precept of developmental guidance, therefore, must be negatively stated: *Avoid doing too much.*

The danger of doing too much has been concretely revealed in the summary of the development of sphincter control. In Chapter xi it was abundantly shown that maturational factors govern the acquisition of voluntary control. A recognition of these developmental factors puts the whole matter of habit training in its proper light. It shows the folly of punishment and anxiety; it explains lapses. Intelligent parents can be made to understand that voluntary sphincter release is every whit as difficult as voluntary release of a grasped cube. If the infant shows physiological awkwardness in manual release, why should he not show it in other neuro-motor functions? Why should he not "fall down" in sphincter control just as he does when he is learning to walk?

We do not scold him for his failure and difficulties in early locomotion. We are not emotionally tense about them. The same objective attitude should be taken in all aspects of child management. The ways of natural growth are truly devious, but in the normal infant we can place much confidence in the surety of these ways. Progressive neuro-motor organization underlies the patterning of all forms of behavior. We do not teach a child to crawl, creep, stand, or walk. We give him opportunity. He does his own growing.

Growth is a key concept which must enter into all guidance. If the physician is convinced of this concept, he will impart its implications. An appreciation of the relativities of growth will make the

parents more philosophical in their outlook on the everyday prob-
lems of child management.

Every parent has some philosophy of life which comes into ex-
pression in methods of management if not in articulate sentences.
If the philosophy is democratic, there will be certain respect for the
individuality of the infant and a degree of tolerance for the difficul-
ties which he encounters in the development of his behavior. Ju-
dicious allowances will be made by such parents for there will be a
desire to arrive at the infant's point of view. And the infant's point.
of view is beyond doubt a developmental one!

The success of child care does not depend so much upon success-
ful rule-of-thumb techniques as upon the underlying attitudes of
parents and attendants. Here lies the most promising field for medi-
cal guidance. The adult-infant relationship is the most vital and most
accessible factor in effecting a mental hygiene of infancy. In almost
a literal sense the physician can reach the mind of the infant by
altering faulty attitudes in the parents. Through his authority and
by tactful suggestion he can moderate emotional tensions and reduce
over-anxiety. When occasion requires, he can liberalize the parents'
philosophical outlook. The physician does not step out of character
when he consciously addresses himself to the adult-infant relation-
ship as a dynamic reality which yields to advisory control. This is the
essence of developmental guidance.

§ 6. DEVELOPMENTAL SUPERVISION

Optimal growth is the inclusive goal of child hygiene. This goal
makes no artificial distinctions between mind and body. It recog-
nizes the total economy of the child and places a premium upon a
personalized, periodic type of developmental supervision.

The medical supervision of nutrition, and physical examinations
at stated intervals throughout infancy must always constitute the
core of child health work. But optimal growth cannot be protected
if medical oversight is limited to dietary regulation, prevention of
disease, and discovery of physical defects. The scope of supervi-
sion should be broadened to include mental health. This can be
done only with the aid of developmental tests, maturity norms,
and examinations of behavior status.

Ideally these examinations should be periodic and although not

as frequent as physical examinations, they may be planned for at stated intervals. Developmental examinations, whether incidental or systematic, serve four good purposes:

(1) They lead to the early discovery of developmental defects and deviations which otherwise would escape notice altogether, or which might suffer from delayed diagnosis.

(2) They make for better working relationships between physician and child.

(3) They meet and help to satisfy the parents' deep-seated interest in the child's development.

(4) They make the physician alert to psychological and mental health factors and thus put him in a better position to give advisory guidance in practical details of treatment, child care and parent-child relationships.

These four objectives fall very naturally within the scope of present day medical practice and scarcely need further comment. To greater or less degree they may be realized in the private practice of family physician and pediatrician, or in the more public practice of examiners attached to hospitals, outpatient clinics, and child consultation centers. These various possibilities will be discussed in the concluding chapter (xx) entitled, Developmental Pediatrics.

The most acute solicitude of parents, of course, arises in the crises of illness and accident. But the most permanent and the deepest concern of parents has to do with *development.* Parents desire health for their children but the insistent inquiries and worries relate to the potentialities of growth and the limits of development. Prolonged illness, sensory and motor handicaps, severe malnutrition, prematurity of birth, convulsions, speech delay, and numerous deviations of conduct lead to vague anxieties about the child's future growth. And even if there are no handicaps, or complications, there is, none the less, a profound interest in the progressions of development. An interest in growth is part and parcel of the parental instinct, even of mothers who have not read any books on child psychology!

It has been said with some truth that many advances in the field of preventive medicine are not so much determined by the findings of science as by public pressure. Radio, press, and schools, and a

host of movements in the field of adult education have caused the demands of parents to become increasingly articulate in all matters pertaining to child care. These demands can be met by a type of supervisory medicine which is realistically concerned with the hygiene of development.

In actual practice this means a clinical kind of parent guidance which is specifically related to concrete problems of child care. The guidance measures may take the form of prescriptive advice or, more often, of explanations which will help the parents to understand the nature of their problem in terms of growth.

As previously indicated, the physician influences the mental health of the infant by altering the faulty attitudes of the parents.

Appendix E describes various books which deal with problems of child care, child guidance and parent guidance from the standpoint of growth and development.

CHAPTER XX

DEVELOPMENTAL PEDIATRICS

Pediatrics is unique among the specialties of clinical medicine. Other specialties are focussed upon a single organ system or some one aspect of the human organism. In contrast, pediatrics is focussed upon the early sector of the life cycle and remains a form of general medicine concerned with the total child. Pediatrics derives its strength and also a distinctive social significance from this kind of specialization.

Whatever social legislation the future may hold, the inherent technological trends in medicine will lead to a mobilization of its diagnostic and supervisory resources at the beginning of the life cycle. By necessity, as well as by tradition, pediatrics holds the most strategic position in the whole scheme of preventive and constructive medicine. Health protection begins with the beginnings of life and growth.

The first task is to insure survival of the newborn infant. The second task is to safeguard his optimal growth. By this simple logic, development as well as disease falls within the province of clinical pediatrics. The present chapter will indicate how the principles and methods of developmental diagnosis can be more fully incorporated into pediatric practice at various levels of application. Developmental Pediatrics is a form of clinical medicine which is directly concerned with the diagnosis and supervision of child development.

§ 1. INDICES OF DEVELOPMENT

Developmental status manifests itself in three major kinds of signs and symptoms: anatomic, physiologic, and behavioral. All of these manifestations are important from the standpoint of a developmentally oriented pediatrics.

Anatomic indices become significant when they go beyond mere height and weight, and deal with girths, body proportions, somato-types, and growth rates. The new interest in the physical anthropology of the child will probably lead to rapid graphic and photographic methods of recording, which will indicate significant growth trends, body type, and constitutional characteristics.

Physiologic indicators can furnish much evidence concerning growth conditions; because the bodily states of the organism change with age. With the remarkable advances now under way in biochemistry, electrometry, and micromeasurements, the physiological diagnosis of development may in time reach a high degree of refinement and accuracy.

Behavior, however, will always remain the most comprehensive and the most sensitive indicator of developmental status. Medically considered, the infant is an action-system which is revealed in patterns of behavior. His behavior characteristics and capacities infallibly express the maturity of his neuro-motor equipment and the achieved efficiency of his total organism.

The developmental diagnosis of infant behavior, accordingly, constitutes the major task of *Developmental Pediatrics*. Anatomic and physiologic criteria of growth and well-being can never be safely ignored or slighted; but they must always be correlated with the crucial criterion of behavior. The motor, the adaptive, the language, and the personal-social behavior of the child sums up most completely his capacity to grow.

To appraise his behavior we need systematic methods of interview, observation, and diagnosis. To elicit significant behavior patterns we must use standard techniques skilfully adapted to individual and age differences. The examination must be conducted formally, with precision of purpose, so the infant will display his most characteristic responses; his postural adjustments, his oculomotor control, his visual and auditory perceptiveness, his co-ordination of eyes and hands, his prehension, manipulation, and exploitiveness; his social awareness and communicativeness; the range and patterns of his attention, his general adaptivity, alertness and competence to meet the total sequence of the examination. An amazingly rich array of significant behavior patterns can be evoked in a period of 15 or 20 minutes, by a standardized sequence which uses

the plain appurtenances of a crib, a table surface, and a series of simple test-objects.

§ 2. THE FUNCTIONS OF DEVELOPMENTAL DIAGNOSIS

In the hands of a clinician, who can bring a background of experience to bear upon his findings, a developmental examination of behavior serves at least five functions:

(1) It ascertains the stages and patterns of developmental maturity in normal, subnormal, and superior infants.

(2) It analyzes the total behavior equipment into components and makes possible differential diagnoses of normality, amentia, and specific developmental deviations.

(3) It brings to light neurological defects and sensory impairments not disclosed by ordinary methods of clinical examination. (It is indispensable for detecting many mild and obscure forms of cerebral injury.)

(4) It supplies important objective information concerning emotional traits and the organization of personality, incidentally it discloses adequacies and inadequacies in the parent-child relationship.

(5) It implements a constructive type of developmental supervision. Periodic developmental examinations define the growth pattern peculiar to the individual child and become the basis of a consecutive individualized child and parent guidance.

§ 3. AREAS OF APPLICATION

The methods of developmental diagnosis are flexible. They can be adapted to meet the urgency of the problem in hand, but they can never be safely replaced by subjective intuition, nor by casual interview. A reliable appraisal requires purposeful procedure. The more experienced the physician, the more he will systematize his observations. He will not rely on general appearances, but will check his impressions against standardized norms. He will use the behavior tests to produce diagnostic evidence and to sharpen his judgment. In final analysis the value of the tests depends upon the skill with which they are applied and upon the insight which is brought to bear by the examiner.

Formalized methods and standardized procedures will serve to extend our present knowledge of growth and development. As in

other fields of clinical medicine, widespread use of routine diagnostic methods leads to useful compilations and critical cross comparisons of data. The following summary will indicate how such methods can be practically developed in five major areas of application:

A. Routine Supervision
B. Periodic Survey
C. Infant Welfare Service
D. Child Care Agencies
E. Medical Center

A. *Routine Supervision.* It is not to be expected that every pediatrician will become an expert in developmental diagnosis, nor that every infant coming under care will have a series of complete and detailed developmental examinations. An accurate developmental history, taken at periodic intervals and checked periodically by a behavior inventory would be amply reassuring in the case of the normal infant, and would select the deviant cases needing further investigation and examination.

The Behavior Inventory is offered, therefore, not as a short-cut examination, nor as a substitute for an examination, but as a minimum check and as a screening device for detecting abnormalities. It is, in essence, a very simply constructed and condensed schedule which gives one or two behavior items *in each field of behavior* at each of nine orientation ages. The child should be checked for each item appropriate to his age, by direct observation and report. For the complete age range of 4 weeks to 3 years the only materials required are a dangling toy, a rattle, a pellet, a few cubes, and paper and pencil; application of the "tests" can be completely informal. The technique of applying the Behavior Inventory is detailed in Appendix A, pp. 406-408.

While the inventory can never take the place of an examination, and does not constitute an examination in any sense of the word, it can be extremely useful. In supervisory practice, such a record periodically checked becomes a part of the history record and in the event of subsequent illness or injury may prove invaluable in establishing or in casting doubt on previous normality, often a very important point.

The inventory serves another valuable function. It tends to keep

the problems of development in focus. It reminds the physician that he is dealing with a growing child and that he must reckon with growth factors in all his supervision. Sleep, feeding, play, toys, exercise, toilet training, discipline, and a whole host of problems of child care have to do with the behavior capacities of the child and with his developmental maturity. These problems can be wisely and individually approached not through blanket rules, but through a recognition of the maturity level at which the child is functioning.

The behavior inventory serves yet another function. It is a screening device. Although it should not in itself establish a diagnosis, it puts the physician on his guard if there are extreme deviations from expected performance. He must, of course, decide whether the variation is normal and benign; or calls for referral. The findings of the inventory may point to some preventive or therapeutic measure. Properly used in conjunction with the interview, the Behavior Inventory promotes the working relationships between parent and physician. It brings mental as well as physical welfare into the scope of supervision. It can be readily incorporated into office practice.

B. *Periodic Survey.* The Behavior Inventory is a somewhat informal device. As the physician gains skill in the use of the inventory he can gradually elaborate it and can undertake a more formal behavior examination at prearranged key ages. He may, for example, schedule appointments for 28 weeks, 1 year, and 18 months; and plan the whole procedure in such a way as to make it an interesting experience for the mother and an agreeable one for the child. To be sure, there are difficulties. Babies often are "afraid" of the doctor. Perhaps he will have to find new ways of handling the immunizations, so as to preserve an optimal relationship with the infant. Unpleasant emotional associations and panicky fears can be circumvented; and a periodic developmental survey designed to afford pleasure (rather than pain) may serve a good purpose toward this very end.

In any event the periodic survey sets the stage for a pediatric type of mental health service. It has unlimited possibilities for the pediatrician whose interest and aptitudes lie in the direction of preventive parent and child guidance.

Intelligent parents are already demanding this kind of medical

service. It is a form of service which should be kept at a high professional level; and should be based on scrupulous diagnosis rather than on preconceived systems of psychotherapy. Developmental pediatrics can ill afford to enter the fields of psychosomatics, unless it is squarely based on the firm foundation of accurate diagnosis.

The periodic developmental survey cannot therefore be altogether assigned to a nurse or to a technician. Its purpose is not to determine a mental age or an I.Q. Tests and measurements are made to furnish clinical data to the physician who must make a responsible diagnosis of the developmental status and the developmental needs of the child under his supervision. This is a responsibility which cannot be delegated.

C. *Infant Welfare Service.* The consultation center for newborn infants, (Consultation de Nourissons), established in Paris by Budin in 1892 was in many respects the most important event in the history of modern preventive medicine. This beneficent arrangement was soon imitated in other lands and has since spread the world over. It represented a new departure in the domain of public health—an individualized clinical type of child protection. As such, it has placed primary emphasis on the nutrition and the physical survival of the infant.

In America the consultation center has characteristically assumed the name of Well-Baby Conference. It is preeminently concerned with well babies and is intent on keeping them well. The main emphasis is still on physical health; but the scope of supervision is steadily widening to include the psychological aspects of child care. The mothers who bring their babies to conference feel free to ask the doctor about any practical matter which bears on the well-being and the management of the children. Almost unconsciously and very informally, the modern infant welfare conference has become a powerful educational as well as protective agency. Its influence has by no means been limited to families of low socio-economic status. In some favored communities, through private medical practice, and through quasi-public conferences, the health protection covers the entire infant population. In a democracy this is a natural goal.

The medical and educational potentialities of infant welfare conferences, however, have been only partially realized. With limited

and shifting personnel, the supervision tends to be sketchy and disjointed. Under more ideal conditions, this supervision should be developmental in spirit and method. This means that it should be personalized, both in terms of the responsible physician and the infant assigned to him. It also means that the physical health protection should be correlated with a consecutive type of parent-child guidance.

At the lowest minimum this would entail a routine form of behavior inventory, supplemented by a periodic developmental survey. Our culture is already ripe for this degree of child protection. We need to prepare personnel for the rising demands of a more thoroughgoing infant welfare service.

D. *Child Care Agencies*. A complete list of the various kinds of agencies and institutions which provide special child care would almost parallel a list of the causes which produce developmental defects and deviations. There are varied organizations and institutions, private, public and quasi-public, which are concerned with dependent, neglected, and defective children, with the blind, deaf, crippled, and otherwise disadvantaged. In nearly all instances these children come first to the attention of the general practitioner and to the pediatrician. Too often they do not come under social and educational oversight until they reach school age.

Any agency responsible for the care or supervision of infants or young children over a long period of time, should assume thereby a solicitude for the child's total developmental welfare. There is a natural tendency to focus too narrowly on the child's specific handicap. Under institutional conditions the medical service tends to limit itself to emergency care, immunizations, and the detection of physical defects. As a result the subtle but inveterate factors of development are overlooked. They can be brought into the scope of medical service only by making determinations and records of developmental status from time to time. This can be done, at least in part, by means of an initial *behavior inventory*, and by periodic developmental surveys as already described.

Usually, however, children who are public or social charges are peculiarly in need of more intensive developmental study. This has been amply demonstrated in the clinical chapters of the present volume. Foundlings, infants born out of wedlock, and other foster

children should have their developmental potentialities determined in advance of adoption and foster home placement. The training and the everyday care of blind and of deaf children should have discriminating regard for emotional and maturity factors. The therapy and management of the crippled child should be based on a careful appraisal of his behavior capacities. Selective cerebral injury must be distinguished from true amentia; and environmental retardation, likewise, must not be confused with amentia. An endless variety of cases require differential and multiple diagnoses. They all require a developmental appraisal which has equal regard for psychological and physical factors. In behalf of these children, particularly in the first five years of life, a developmental type of pediatrics should be available to child care agencies.

E. *Medical Center.* We use the term medical center flexibly to denote a well equipped hospital which maintains basic diagnostic departments, and is staffed with specialists for group and referral diagnoses. This would include teaching hospitals which provide in-training and postgraduate courses and conferences. Such medical centers are at present most highly developed in metropolitan communities. But with the growth of regional hospitals and health centers comparable facilities will become more widely available.

In a diversified medical center, developmental pediatrics attains the status of a diagnostic specialty. As such it has a separate locus, special examining rooms, and appropriate equipment as described in Appendix C of this volume. It functions in a manner not unlike radiology, cardiology, ophthalmology, or any other diagnostic department. It uses its distinctive techniques to determine maturity status and developmental outlook, supplying data which are pertinent for group diagnosis, for therapy, and for guidance.

Such a department is in no sense a mere mental testing station. A mental age or an I.Q. or even a D.Q. has no value apart from clinical interpretation. Developmental diagnosis is significant only when it is related to other clinical evidence. In a medical center the findings of the developmental examination can be closely correlated with neurological, orthopedic, and other clinical data. These findings are of special importance in complex cases requiring differential diagnosis and careful follow-up. With consecutive examinations the significance of the developmental findings increases.

The physical arrangements for a division of developmental diag-

nosis at a medical center should be planned to insure optimal responses on the part of the infant and young child. The surroundings should awaken a sense of confidence in the parents as well. The parents, indeed, should be allowed to observe the examination because this helps them to gain insight into the nature of their problem. The developmental unit offers a favorable setting for imparting the initial diagnosis and guidance; it also facilitates systematic follow-up supervision through the periodic contacts which are so essential in the care of cases of maldevelopment. The unit serves equally well as part of a child health center for the examination and the supervision of normal and relatively normal infants and young children.

Such a unit simply but attractively furnished has an important psychological effect within the environs of a hospital. It helps to counteract some of the prejudices which are too closely associated with hospital and institutional surroundings. The problem of the handicapped child in particular often causes intense emotions on the part of the family. The emotions may persist a long time and they tend to express themselves in resistance to diagnosis and advice. The resistance increases if the examination of the child is conducted in surroundings which apparently are unfavorable to the child. A properly equipped unit, on the other hand, has a reassuring and tranquilizing influence. This should be more definitely recognized in the planning of arrangements for developmental supervision and child health services. Incidentally, a one-way-vision screen serves a valuable function. It reduces disturbing distractions. It allows one or both parents to observe the examination with a sense of participation as well as detachment.

The one-way-vision screen facilities also are invaluable for the purposes of demonstration to students and to internes and residents in training.

If a developmental type of pediatrics is destined to become a major feature of clinical medicine, it is desirable to consider problems of professional training.

§ 4. MEDICAL EDUCATION FOR DEVELOPMENTAL PEDIATRICS

Ideally the training of physicians in the field of developmental pediatrics should begin in the undergraduate years. Thereafter, it may be carried through to a high level of postgraduate specializa-

tion. The medical student in his preclinical and clinical years should have more systematic instruction in the physical and physiological aspects of child development. This need not entail a multiplication of independent courses. On the contrary, an adaptable educational program would correlate an increasing amount of teaching and demonstration about a few key subjects such as *Growth and Development.*

The student of pediatrics, in particular, should be infused with the doctrine of development, because this alone can give him adequate perspective for appraising the normal and abnormal symptomatologies of infancy. By systematic consideration of the somatic, physiologic, and behavioral manifestations of development, it will be possible to raise the study of normality to the dignity of a clinical subject. Clinical and supervisory pediatrics is preeminently concerned with the protection and the augmentation of normal well-being. For this reason it is anomalous that the critical diagnosis and interpretation of normal child development has such meager status in medical education.

The study of normal and abnormal child development can be carried on in close correlation; but knowledge of normality is basic and should be pursued systematically. Appendix D, pp. 456-467, describes how this can be done with the aid of motion picture films which depict the behavior patterns characteristic of normal infants at advancing age levels. By means of a personal desk viewer, under his own control, the student examines these behavior patterns and makes himself familiar with their developmental progressions. He analyzes the films in much the same manner that he studies his histological slides. This cinemanalysis is a laboratory method of self study, which makes behavior virtually as tangible as tissue.

The morphology of abnormal patterns can also be studied with profit by the same intimate method of cinemanalysis. With current advances and simplifications in · photographic technique, cinema records of infant behavior, normal, defective, and deviating, may well become as routine as x-ray films: serving a similar purpose both for instruction and for diagnosis.

Specialization in the field of Developmental Pediatrics requires a rigorous course of training based on ample experience both with normal and with abnormal infants and young children. This necessi-

tates, as already suggested, facilities for developmental examinations set up in a separate diagnostic unit, with suitable equipment and competent clinical personnel. In a hospital or teaching center a well grounded pediatrician can be trained to expertness in one or two years of full time participation in a diagnostic and advisory service which deals with a wide range of normal and abnormal developmental conditions. Ideally this specialized training should include the periodic contacts of well-baby supervision, the examination of infants prior to adoption and foster home placement, of preschool children under nursery school auspices, and the differential diagnosis of a diverse array of mild and severe abnormalities, including retardation, amentias, aplasias, malformations, degenerative processes, cerebral injuries and other traumata, anoxemia, infections and toxic lesions, endocrine dysfunctions, sensori-motor handicaps, and environmental shocks and stresses.

The mere enumeration of all these conditions reminds us how gravely they may be neglected in the absence of facilities for developmental diagnosis and supervision. In virtually every instance, whether the child be normal, handicapped, or defective, the crucial medical and social problems call for a judgment as to developmental status, developmental outlook, developmental guidance. And since these problems all gravitate in their first, infant phase to the pediatrician and the family doctor, the primary responsibility for their solution gravitates to the pediatric contingent of the medical profession.

We know of no other specialty equipped to take over this task of preventive and supervisory medicine. Allergist, cardiologist, orthopedist, neurologist, and psychiatrist all have a role to play; but the pediatrician alone is conversant with the infant as a whole and he is preeminently concerned with the maintenance of a forward-moving sequence of development. The pediatrician is adept with babies, and by tradition he is interested in their total welfare. So he is in a favorable position to go along with the new trends of psychosomatic medicine, and with the new scientific emphasis on the dynamics of development.

The historical evolution of clinical pediatrics has very naturally brought about a preventive outlook upon the period of infancy and early childhood. Psychiatry, on the other hand, has derived its con-

cepts largely from the psycho-pathology of the adult, and has been preoccupied with the interpretation and treatment of mental disease. Recent extensions into the adolescent and preadolescent period therefore reflect the methods and the outlook of adult psychiatry. Accordingly, child psychiatry has made its most characteristic contribution in psycho-therapy, and in the elucidation of the abnormal behavior which manifests itself in juvenile conflicts with adult culture.

For the vast work of preventive mental hygiene, however, we must look to pediatric medicine. In principle and in actuality, pediatrics is already committed to a form of supervisory health protection which includes mental as well as physical welfare. Since bodily growth and psychic development cannot be divorced, the methods of developmental pediatrics contain the essence of a preventive psychiatry of infancy and childhood.

To understand any child, whether normal or handicapped, we must understand his ways of growth. These ways of growth are the sum and substance of his psychosomatic constitution. Only as we become aware of these ways of growth, can we plan adequate procedures of guidance and control. Here lies the significance of a periodic examination of infant behavior as a pediatric approach to the mental hygiene of early child development.

APPENDICES

A. Examination Technique

B. Growth Trend Chart

C. Examination Equipment

D. Cinematic Case Studies

E. Readings on Developmental Guidance

F. Professional Training For Developmental
   Pediatrics

APPENDIX A

EXAMINATION TECHNIQUE

The basic methods of procedure for the developmental examination of behavior have been fully outlined in the body of the text. Appendix A is in the nature of a brief manual of directions which assembles the details for convenient reference in nine sections:

§ 1. TEST MATERIALS

The test materials for the developmental examination are so simple that they need no elaborate description here. They are pictured in Figure 7 (page 20). Complete specifications of the materials can be found in earlier publications as listed in Appendix D, § 4.

Some of the materials can be readily secured or improvised. Care should be taken, however, not to use objects which in dimensions, texture, and appearance are different from those prescribed. The materials are being distributed on a non-profit basis by The Psycho-

logical Corporation, 522 Fifth Avenue, New York, N. Y. They may be purchased singly or in complete sets at cost.

A list of the materials needed for carrying out the examination outlined in the present volume follows.

Ball, large	Formboard blocks (3)
Ball, small	Picture book
Bell	Picture card (a)
Bells on ring (catbells)	Picture card (b)
Bottle, glass	Pellets
Color forms and card	Performance box
Crayons	Rattle
Cubes	Rod
Cup	Test objects { pencil / key / knife
Formboard, 3 figure	
	Tricolored rings or plaques

The Psychological Corporation also furnish blueprints and specifications for the following special clinical equipment:

*Infant examining chair (Figure 17)
*Clinical crib (Figure 16)
*Table top for clinical crib (Figure 16)
 Portable test table (Figure 19)
*Clinical high chair and adjustable table (Figure 18)

The following items are obtainable on the open market:
 Kindergarten table
 Kindergarten chair
 Mirror (attach roller shade)
 Cardboard screen (for multiple cubes)
*Play Pen (Figure 20)

§ 2. EXAMINATION SEQUENCES

So far as possible the standard sequence should be followed in the administration of the developmental test situations. The standard sequence naturally differs with the maturity and age of the child. There are four maturity zones as follows: Supine, Sitting, Locomotor, and Pre-kindergarten. The recommended standard sequence for each of these maturity zones is tabulated on the following pages.

* The starred equipment is not essential if an examining table, portable test table, kindergarten table and chair are provided.

EXAMINATION SEQUENCES

Supine

4 Weeks Zone 0 – 4 – 8 weeks	16 Weeks Zone 12 – 16 – 20 weeks
*Situation No.**	*Situation No.*
Supine...........................1	Supine...........................1
Dangling ring.....................2	Dangling ring.....................2
Rattle...........................3	Rattle...........................3
Bell ring.........................4	Bell ring.........................4
Social stimulation..................5	Social stimulation.................5
Pull-to-sit.......................6	Pull-to-sit.......................6
Sit–supported.....................7	Sit–supported.....................7
Stand–supported..................46	Cube 1...........................8
Prone...........................47	Cup–inverted.....................17
	Pellet...........................19
	Bell.............................22
	Stand–supported..................46
	Prone...........................47

Sitting

28 Weeks Zone 24 – 28 – 32 weeks	40 Weeks Zone 36 – 40 – 44 weeks
Situation No.	*Situation No.*
Cube, 1, 2, 3 ....8, 9, 10	Cubes 1, 2, 3..................8, 9, 10
Massed cubes 13	Massed cubes.....................13
Pellet...........................19	Cup and cubes.....................18
Bell.............................22	Pellet...........................19
Ring and string....................23	Pellet in bottle...................20
Supine...........................1	Pellet beside bottle................21
Dangling ring 2	Bell.............................22
Rattle...........................3	Ring and string....................23
Bell ring..........................4	Formboard.......................32
Social stimulation..................5	Ball play.........................39
Pull-to-sit.......................6	Mirror...........................44
Sit–supported 7	Mirror and ball....................45
Mirror...........................44	Sit–free.........................48
Stand-supported 46	Creep...........................49
Prone...........................47	Rail.............................50
	Cruise...........................51
	Walk–supported...................52

*This number identifies the text situation as described in the procedural syllabus, p. 382 ff.

EXAMINATION SEQUENCES

Locomotor

12 Months Zone 48 − 52 − 56 weeks		18 Months Zone 15 − 18 − 21 months	
Situation No.	*Situation No.*	*Situation No.*	*Situation No.*
Cube 8, 9, 10	Mirror & ball...45	Picture book.....12	Formboard......32
Tower.........11	Sit–free........48	Cubes..........13	Picture card (a) .33
Cubes..........13	Creep..........49	Tower........14	Performance
Cup and cubes...18	Rail............50	Train........15	box..........37
Pellet in bottle...20	Cruise.........51	Cup and cubes...18	Test objects.....38
Pellet beside	Walk–sup-	Pellet & bottle...21	Small ball
bottle.......21	ported.......52	Drawing	Throwing 39
Ring & string...23		Spontaneous...24	Directions.....40
Formboard......32		Scribble.......25	In box........41
Ball play........39		Strokes.....26, 27	Kicking........43
Mirror.........44		Circular	Sit–chair........48
		scribble......29	Walk, run.......53

Pre-kindergarten

2 Years Zone 21 − 24 − 30 months		3 Years Zone 30 − 36 − 42 months	
Situation No.	*Situation No.*	*Situation No.*	*Situation No.*
Picture book.....12	Picture cards....33	Picture book.....12	Picture cards....33
Cubes..........13	Performance	Cubes..........13	Digits....... ..34
Tower........14	box........37	Tower........14	Name, sex......35
Train.........15	Test objects 38	Train.........15	Comprehen-
Cup and cubes...18	Small ball	Bridge........16	sion........36
Drawing	Throwing 39	Drawing	Small ball
Spontaneous...24	Directions.....40	Spontaneous...24	Throwing 39
Strokes.....26, 27	In box.......41	Strokes.....26, 27	Prepositions....42
Circular	Kicking........43	Circle.........28	Kicking.........43
scribble......29	Sit–chair.......48	Cross.........30	Sit–chair.......48
Formboard......32	Walk, run.......53	Color forms.....31	Walk, run......53
		Formboard......32	Stand 1 foot 54

These tables also serve as a *finding list for all the examination situations*. Each situation is assigned an identification number. This number refers to the procedural syllabus (pp. 383 ff.) in which each situation is separately described.

§ 3. INDUCTION TO THE EXAMINATION

Preliminaries and introductory procedures must be adapted to the general maturity characteristics of the child. Special suggestions and directions for making an easy, natural transition to the formal examination are briefly given below.

4-20 Weeks Maturity. At a favorable moment when the infant is quiet and contented, ask the mother to place him lying down on the examining table (or crib platform). The surface should be padded, the resistance that of a firm flat mattress. The examiner stands at the infant's left; the mother is invited to take a chair placed at the infant's right. The Supine Situations (1) follow.

24-36 Weeks Maturity. At a favorable moment when the infant is unapprehensive and playful, offer him an introductory toy.* When he accepts it, place a second introductory toy on the table top in his plain view, and take your place at the left of the crib or examining table. If a clinical crib and chair are available ask the mother, who is on the right of the crib, to place him in the chair and to "stand by" until all is well. Secure the belt around his chest, move the table top into position, and if necessary call the infant's attention to the toy on the table. As soon as he begins to play, the mother sits down at the right. If there is no crib, ask the mother to seat herself in a chair at the head of the examining table, to seat the child before her on the end of the table; the mother supports the infant with both hands. The examiner moves the portable table into place and calls attention to the toy on the table.

The appropriate Table Top Situations (8) follow.

40-56 Weeks Maturity. Offer the introductory toy; when the infant accepts it, ask the mother to place him seated on the crib platform or examining table before the table top. She "stands by" until all is well. The table top is moved into place by the examiner who stands at the left (the mother is at the right), and the infant's attention is called to the introductory toy on the table top. As soon as the infant begins to play, the mother may sit down.

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* Tricolored rings or catbells.

The appropriate Table Top Situations (8) follow.

15 Months Maturity. A clinical high chair is ideal for this age. If it is not available, placement in the kindergarten chair before the kindergarten table is probably best. The introductory toy is on the table when the child is placed in the high chair by the mother. She offers reassurances and interests him in the toy while chair and table are locked together and adjusted. The mother seats herself at the child's right, the examiner at his left. The appropriate Table Top Situations (8) follow.

18-36 Months Maturity. The child is invited to play with some toys. He is shown the kindergarten table with the picture book on it, and shown his chair. The mother seats herself at the right of the table, the examiner at the left. The mother may be asked to help the child into his chair. When the child is behind the table, in position, seated or perhaps still standing, the examiner begins to demonstrate the Picture Book (12) which follows.

Note: The mother takes the active part in the induction. The examiner does not touch the child, but keeps his distance. This applies to all the age ranges.

§ 4. TEST PROCEDURES

The purpose of this section is to outline in the briefest way possible the specific procedures used in administering the individual test situations. The general character of these procedures has already been indicated in Chapters III and IV. It will be recalled that the examination is conducted as an organic unit, one situation moving into the other by easy transitions. The examiner does not regard the examination as a series of rigidly separate tests. He knows that he must proceed from one situation to the next in such a way that the child's working rapport is not only preserved but actually increased. As a clinician he will naturally use a little finesse.

On the other hand, the examination must not assume so much informality that the tests lose their integrity as diagnostic tools. They must be administered in a prescribed standardized manner, and the examiner must strike a very careful balance between uniformity and variation.

The recommended standard procedure for each test situation is succinctly described in the following syllabus. Each situation carries

an identification number in the left margin of the syllabus (the same number which was assigned in the table of sequences, pp. 379-800.

Supine Situations

1 | SUPINE

4-28 Weeks Maturity. The examiner simply observes the child's posture and spontaneous activity. If necessary he may be spoken to in a reassuring tone. At *28 weeks* the infant may resent being placed down; offer the dangling ring immediately without preliminary observation. If he is not immediately appeased, skip to the Pull-to-Sitting Situation (6) at once.

Ordinarily the Dangling Ring Situation (2) follows.

2 | DANGLING RING

4-28 Weeks Maturity. The end of the string is held in the examiner's left hand and the ring permitted to hang down. In this manner the ring is brought about 4-6 inches above the infant's feet and then moved headward until it is above his face. If the infant's head is turned to the side, move the ring into the line of vision. Observe the reaction to the perception of the ring.

(a) *Ring following: 4-16 Weeks Maturity:*

Then move the ring slowly through an arc of 180° from one side of the infant's head to the other, keeping the distance from the head about constant. Repeated trials may be made, and every opportunity should be given the infant to demonstrate his optimal capacity to follow a moving object (ring or examiner's hand). The speed of the moving ring should be adapted to the infant's abilities in ocular pursuit.

(b) *Ring exploitation: 16-28 Weeks Maturity:*

If the infant reaches for the ring immediately, ring following is omitted. The ring is held suspended within reach above the upper chest or face, and the infant's prehensory efforts are observed. The ring may be steadied if he sets it swinging. If necessary it is placed in his hand, selecting the hand most favorable for ring regard; his perceptual and manipulatory exploitation of the ring is observed. If he drops the ring before observations are complete, it may be restored to his hand; otherwise it is gently recovered and the Rattle (3) immediately presented.

3 | RATTLE

4-28 Weeks Maturity. The rattle is held in the examiner's left hand and presented within reaching distance over the upper chest of the supine infant. His perceptual response is observed, and the rattle may

be moved into the line of vision if the infant's head is everted, or it may be gently shaken to elicit attention. The infant is allowed to grasp the rattle if he can, or it is brought near his hand, or finally placed in his hand. The hand most favorable for rattle regard is selected and the fingers may have to be opened. His exploitation of the rattle is observed and also his response to loss of the rattle. If he retains it, it is gently removed and placed at his side to determine his ability to pursue the lost rattle.

4 | BELL-RINGING

4-28 Weeks Maturity. The bell is sharply rung, then silenced, about 2-3 inches from first one ear then the other, and the adaptive response noted. The examiner should take care that the infant does not spy the bell. A bell on either side, one with clapper and one mute, can be used but this precaution is not really necessary. After 28 weeks, if there is any question of a hearing defect, this test should be opportunistically tried.

5 | SOCIAL STIMULATION

4-28 Weeks Maturity. The infant is gently shifted so that he lies across the table (or crib), or the examiner may make the shift himself, taking his position at the infant's feet. The examiner bends over the infant, takes his hands and smiles and talks, endeavoring to elicit attention and social response. The situation is not prolonged; it is continuous with the Pull-to-Sitting Situation (6).

At the older ages social responses are opportunistically elicited.

Supported Sitting Situations

6 | PULL-TO-SITTING

4-28 Weeks Maturity. Holding the infant's hands in his own, and having secured the infant's attention if possible, the examiner exerts gentle, steady forward traction on the arms. If the infant's head lags excessively, the traction is released and the infant is raised to the sitting position with head supported. Otherwise the Pull-to-Sitting is completed and the infant's head control and participation in the pull are noted.

7 | SITTING (SUPPORTED)

4-28 Weeks Maturity. After the pull is completed, the examiner shifts first one hand, then the other, so that he supports the infant by the sides of the thorax. Sitting posture and control are observed; the examiner may release his support slightly to determine the infant's participation

in the sitting act. The infant should, of course, not be permitted to fall, nor to lean too far forward, nor should this test be at all prolonged.

28-36 Weeks Maturity. Beginning at 28 or 32 weeks, the Supine and Pull-to-Sitting situations are omitted and the child has been exploiting the table top situations. At the conclusion of the table top situations, the test table is removed. The examiner seats the infant on the platform, and removes his hands though they remain protectively near. If necessary the infant's legs should be arranged in flexion and abduction and his hands placed in a propping position by his feet. If he maintains his balance a lure (tricolored rings or catbells) may be offered to test his ability to lift one hand and still maintain the position, and to induce, if possible, an erect sitting position. The examiner is on the alert to protect the infant from losing his balance.

Table Top Situations

Note: At *24 weeks* of age and thereafter the examination begins with the table top situations. At *24* and *28 weeks,* the supine and postural situations follow the table top situations. Thereafter the supine situations are omitted.

Presentation (12-56 Weeks). All single test objects of this group are held in the examiner's left hand; the object is brought to the center of the far edge of the table and the infant's attention to the presentation is elicited, if necessary by tapping the object against the table edge. In extreme cases it may be necessary to use other methods to elicit attention; their use should be noted. When attention is secured, the object is brought toward the infant and placed in easy reach on the table before him. In presentation, the object should be so held that it is more conspicuous than the examiner's hand. Placement should be central to favor a free choice of handedness in grasp. The examiner should withdraw his hand as inconspicuously as possible.

From *15-36 months* the presentations are made by simply reaching in from the left and placing the test objects in easy reach on the table before the child.

The presentation of multiple object situations will be described individually.

Transitions. In making the transition from one situation to another in the table top situations, the examiner should take advantage of the infant's dropping a toy to substitute the next. If necessary to

remove a toy from the infant's hand, it should be lightly grasped and then the examiner should wait until the infant releases the object. It is at times necessary to present the next object, permitting the infant to retain the one in hand until it can be opportunistically withdrawn. Transitions should be smoothly made; the infant should never have to wait for the next object.

Note: No situation is prolonged. One or two minutes of exploitation is usually ample.

8 | FIRST CUBE

12-56 Weeks Maturity. The cube is presented and the infant's responses are observed. If necessary, the cube is offered to his hand, or even placed in the hand.

9 | SECOND CUBE

20-56 Weeks Maturity. While the infant is holding the first cube, the second is presented, and the response is observed.

10 | THIRD CUBE

20-56 Weeks Maturity. While the infant is holding two cubes which may be placed in his hands if necessary, the third cube is presented, and the response is observed.

11 | TOWER OF TWO

48-56 Weeks Maturity. The examiner secures the child's attention, then builds a tower of two cubes, places a third cube within easy reach on the table and offers the child a fourth. He may point to the third cube, and he may dismantle and replace the demonstration tower once or twice to induce performance. The demonstration tower should not be out of reach.

12 | PICTURE BOOK

15-36 Months Maturity. In this age range the examination begins at this point; all the previously described situations are omitted. The picture book is on the table and the examiner may call attention to the salient features on each page, may ask for comments and responses on each page, or may skip through the book rapidly. The situation is used to introduce the examination, to get the child talking if he will, or to give the examiner a chance to disarm the child by responding for him.

At *15-24 Months* the child is asked to name or point to eyes, shoes, hat, dog, spoon, umbrella.

At *30-36 Months* he is also asked to tell what the child is doing (crying, eating, sleeping).

At *36 Months* he may be asked to recite a familiar nursery rhyme, with or without help.

13 | MASSED CUBES

(a) *24-56 Weeks Maturity.*

With the right hand the examiner holds a small cardboard screen in front of the ten cubes as he arranges them with his left hand into a square of nine, the tenth cube surmounting the mass. (See illustration in Chapter IV). Screen and cubes are then advanced into position, when the screen is removed exposing the formation of cubes. Cubes that the infant pushes to the platform or floor are retrieved later; cubes that he pushes out of reach on the table may be moved nearer. If necessary he may be helped to grasp a cube.

At *48-56 Weeks*, if tower building was not elicited during the Tower of Two situation, another attempt may be made to elicit this behavior.

(b) *At 15-36 Months*, the screen is not used. The cubes are placed in position and the child is asked to "make something." His spontaneous exploitation of the cubes is observed.

14 | TOWER

15-36 Months Maturity. While the child is holding a cube, the examiner points to a cube on the table saying, *"Put it here."* If the child does not comply, the examiner may start the tower, placing on one or more cubes. Each time the child places a cube on successfully, or at appropriate intervals, he is praised, *"Good!"*, and encouraged to continue.

15 | TRAIN

18-36 Months Maturity. The examiner says, *"I'll show you how to make a choo-choo train,"* and removes all the cubes. He then shows the child how to align four cubes and place a fifth on top of an end cube, saying, *"These are the cars; this is the chimney for the smoke to come out."* He pushes his train across the table saying, *"Choo-choo-choo"*; then dismantles the model, shoves the disarranged cubes toward the child. *"You make it."*

16 | BRIDGE

30-36 Months Maturity. The examiner says, *"Now I'll show you how to make a little house,"* and removes all the cubes. He then shows the child how to place two cubes in alignment but slightly separated, and bridge them by placing a third cube on top. *"And this is the roof."* He points out the separation, saying, *"See the little door?"* Leaving the model in place, he gives the child three cubes. *"You make it down here."*

17 | INVERTED CUP

12-28 Weeks Maturity. The cubes are removed and the cup is presented, inverted so that the rim rests on the table, the handle pointing directly at the child.

18 | CUP AND CUBES

32-56 Weeks Maturity. The examiner gathers the ten cubes into his left hand, and takes the cup, upright this time, in his right hand. The contents of both hands are presented from the left side and placed on the table, the cubes to the infant's right, the cup to the left. His spontaneous play is observed. While the infant holds a cube, the examiner points into the cup, saying, *"Put it in there."* If he does not comply, the examiner takes a cube and securing the infant's attention, drops the cube into the cup. His responses are then observed.

15-24 Months Maturity. The examiner places the ten cubes in an irregular mass on the table top at the child's right, the upright cup at the left, presenting them simultaneously. If the child does not begin to insert the cubes, the examiner says, *"Put the blocks in."* If the child hesitates, or starts removing the cubes after a few are inserted, say, *"More." "Put them all in,"* and push one cube after another toward the child by way of proffer.

19 | PELLET

12-65 Weeks Maturity. The examiner presents the pellet, flat side up. If it is hit from position it is restored. The examiner intervenes, if possible, before the infant carries the pellet to the mouth. If the infant is too quick, the mother is reassured that the pellet is harmless. Infants usually let the pellet slip out of the mouth, sooner or later, when it can be removed.

20 | PELLET-IN-BOTTLE

36-56 Weeks Maturity. The examiner takes the bottle in the left hand and holds it at about the level of the infant's eyes. The pellet, in the right hand, is held over the mouth of the bottle. Securing the infant's attention to the pellet in hand, it is dropped into the bottle. The bottle is then placed on the table or the infant is allowed to take it from the examiner.

21 | PELLET-BESIDE-BOTTLE

36-56 Weeks Maturity. This time the examiner holds the pellet in the left hand, the bottle in the right. They are presented simultaneously from the left and placed side by side on the table top, the pellet at the infant's right. If the infant picks up the pellet, the examiner points to the mouth of the bottle saying, *"Put it in."* As in the pellet situation, the examiner should forestall the infant from eating the pellet. The infant may be allowed several opportunities to insert the pellet.

15-24 Months Maturity. As at the younger ages the examiner presents the pellet and bottle simultaneously from the left, placing them side by side on the table top, the pellet at the child's right. He is asked to put the pellet in the bottle. After he has inserted the pellet, the examiner says, *"Get it out." "Get the candy."* At the conclusion of this situation he may be allowed to eat the pellet if he wishes.

22 | BELL

12-48 Weeks Maturity. The bell is presented and placed standing upright on the table top. If necessary the infant is assisted to grasp it; it can be restored if it is dropped.

23 | RING AND STRING

28-56 Weeks Maturity. The examiner holds the ring in the right hand, the end of the string in the left, pulling the string taut. The ring is placed in the center at the far edge of the table (out of reach), the end of the string obliquely toward the right (within reach). If the string is flipped out of position it may be restored. If the string is ignored in the oblique position, it may be placed with the end of the string directly in front of the infant. If he is unable to secure the ring and threatens to cry, it is moved within reach.

Drawing Situations

[*Note:* If in this and subsequent situations the child objects to releasing the crayon, the examiner may use a second crayon. In this case, he must conceal this crayon after each demonstration. Each demonstration should have the child's attention, and be made so the child can see what is being done.]

24 | SPONTANEOUS DRAWING

52 Weeks—36 Months Maturity. A piece of letter-sized paper is presented from the left and placed on the table top directly before the child. The examiner steadies the paper with his left hand, unless the child objects, and places the crayon in the center of the paper, pointing away from the child. He may be asked to "make something." At *24-36 months* he may be asked what he has made.

25 | SCRIBBLE IMITATION

15-24 Months Maturity. The examiner takes the child's crayon in his right hand, saying, *"Thank you,"* and turns over the paper the child has been marking on. Holding his arm elevated so that his arm and hand do not obstruct the child's view, and securing the child's attention, the examiner scribbles back and forth several times across the top of the paper. He then replaces the crayon in a central position, saying, *"You make it."*

26 | STROKE—VERTICAL—IMITATION

15-36 Months Maturity. The examiner takes the child's crayon and supplies a fresh sheet of paper. He then draws one or two decisive strokes down the left margin of the paper, releases the crayon centrally, saying, *"You do it."* The stroke movement may be slightly exaggerated.

27 | STROKE—HORIZONTAL—IMITATION

18-36 Months Maturity. The examiner takes the child's crayon, turns the paper over, and draws one or two decisive strokes across the top margin of the paper, releases the crayon centrally and says, *"You make it."*

28 | CIRCLE—COPY

30-36 Months Maturity. The examiner supplies a fresh piece of paper. He shows the child a card on which a circle (diameter 8 cm.) has been drawn, saying, *"Make one like this"* (pointing) *"on the paper"* (pointing). If the child's response is unsatisfactory the Circular Scribble (29) follows.

If he copies the circle, the Cross demonstration follows.

29 | CIRCULAR SCRIBBLE—IMITATION

18-30 Months Maturity. The examiner takes the child's crayon and using a fresh piece of paper, makes a decisive circular scribble, going round and round, at the top of the page. He releases the crayon centrally, saying, *"You make it."*

30 | CROSS IMITATION

30-36 Months Maturity. The examiner takes the child's crayon and using the reverse side or a fresh piece of paper, makes a decisive cross at the top of the paper, saying with each stroke, *"One like this, and one like that."* He releases the crayon centrally saying *"You make it."*

[*Note:* The circle and cross are never named to the child.]

31 | COLOR FORMS

30-36 Months Maturity. The color card is placed on the table top, and the child's attention is called to the forms on the card. He is then given the cut-out *round* form, and asked *"Where does it go?"* *"You put it on."* If he misplaces it, the examiner demonstrates and allows the child to place it. He is then given, in order, the *square,* the *triangle,* the *semicircle,* and the *cross.* The round form is the only one demonstrated; all other placements are accepted by the examiner who merely says *"Good"* after each placement, whether right or wrong.

32 | FORMBOARD

[*Note:* The examiner introduces the formboard from the left and places it on the table top before the child, the round hole at the child's right, the apex of the triangular hole pointing away from the child.]

44-56 Weeks Maturity. The examiner holds the formboard securely on the table with his right hand and with his left hand offers the infant the round block, presenting it centrally. After the infant has manipulated the block, the examiner points to the round hole, saying, *"Put it in."* The examiner then takes the round block and ostentatiously inserts it in the

round hole. If the infant cannot remove it, the examiner takes it out, restores it to the infant and again tries to induce insertion.

15 Months Maturity. The examiner holds the formboard securely on the table with his right hand and with his left hand offers the child the round block, presenting it centrally. After the child has manipulated the block, the examiner points to the round hole, saying, *"Put it in."* Either the child or the examiner then inserts the block. The examiner then lifts the board, leaving the block on the table, and turns the board through an arc of 180°, keeping it flat. As he releases the board on the table, he shoves the block to the table edge at the right. The round block is now on the table directly in front of the square hole. If the child does not pick up the block, the examiner offers it centrally. *"Put it in."* The child will probably not respond to more than one rotation.

18-36 Months Maturity. The examiner releases the formboard on the table and places in front of it (on the table between board and child) the three blocks, the round in front of the round hole, triangle in front of the triangular hole, etc. *"Put the blocks in."* If the child has difficulty in adjusting corners in insertion he may be assisted. If he piles the blocks, etc., then insertion is demonstrated, the examiner patting each block into place, and the situation is re-presented. When all three blocks are in, the examiner lifts the board, leaving the three blocks on the table, and turns the board through an arc of 180°, saying, *"Watch!"* In this manoeuver he keeps the board flat. As he replaces the board on the table, he shoves the blocks toward the edge of the table; the blocks are between the board and the child. The round block is now on the table directly in front of the square hole and vice versa. *"Put them in again— nicely."* If the child makes an error and persists in it, the examiner may say, *"Where does it go?"* and finally point to the correct hole. Repeated trials may be given.

Verbal Situations

[*Note:* If the child fails to talk, all the verbal situations except Picture Cards are omitted.]

33 PICTURE CARDS

(a) 4 pictures (cup, dog, shoe, house)

18-36 Months Maturity. The picture card is presented from the left, the examiner retaining hold of the card. The examiner points to the pictures, asking, *"What is this?"* in the following order: (1) dog, (2) shoe, (3) cup, (4) house. If the child does not name any, ask in the same

order, *"Where is the doggie* (or *bow-wow*)?" etc. *"Show me where it is."*

(b) *6 pictures* (flag, clock, star, leaf, basket, book)

21-36 Months Maturity. The examiner says, *"Here are some more pictures,"* presenting the card from the left and retaining hold of the card. The examiner points to the pictures asking *"What is this?"* in the following order: (1) clock, (2) basket, (3) book, (4) leaf, (5) flag, (6) star. If the child does not name any, ask in the same order, *"Where is the clock* (or *tick-tock*)?" If he does not respond to the first two or three pictures, the remainder are omitted.

34 | DIGIT REPETITION

30-36 Months Maturity. If the child is giving verbal responses fairly freely, say to him, making the question rhetorical, *"Will you say 1-2?"* *"Good."* *"Now say 6-4-1."* The numbers should be recited in a spaced manner. The following digit series may be tried: 641, 352, 837. Do not repeat a series. If necessary ask the child to wait until you have finished.

35 | NAME AND SEX

30-36 Months Maturity. The examiner says, *"What is your name?"* If the child does not respond or only gives his first name (or nickname), the examiner says *"(Johnny) what?"* A response is never insisted upon.

The examiner then says to a girl, *"Are you a (little) girl or a (little) boy?"*; to a boy, *"Are you a (little) boy or a (little) girl?"* He may also say, *"Which are you?"* if the response is unsatisfactory. Do not say, *"Are you a girl?"*—if the question is to be repeated, give the full form.

36 | COMPREHENSION QUESTIONS

36 Months Maturity. The examiner asks, in order,
"What do you do when you are hungry?"
"What do you do when you are sleepy?"
"What do you do when you are cold?"

37 | PERFORMANCE BOX

18-24 Months Maturity. Holding the box in the left hand by the handle and keeping hold, the examiner presents the box from the left. The holes in the side of the box face the child. The examiner offers the round rod with his right hand. If the child does not bring it to the correct hole, it is indicated to him. *"Put it in,"* *"All the way."* If necessary, the examiner completes the insertion, or demonstrates insertion. The open end of the box is then turned toward the child and he is invited to get the rod out.

Tilt the box a little if necessary. Return the box to position, and say, *"Do it again."* This time the examiner removes the rod, and offers the square white block instead. *"Put it in."* Indicate the correct hole if necessary. A partial demonstration is then made if the child is unsuccessful. In restoring the block to the child after demonstration, turn the block in handing it to him, so that he must make a manual adjustment to insert it. If failure threatens to annoy the child, assist him to insert it.

38 TEST OBJECTS

18-30 Months Maturity. The examiner shows the child the following objects, in order: penny, pencil, shoe (the examiner's), key, knife, small ball, saying, *"What is this?"* If the child responds correctly say, *"What do you do with it?"* The examiner retains possession of all the objects except the ball, which the child is allowed to take. If the child does not respond to the first two objects, skip to the small ball.

Small Ball Situations

39 BALL PLAY

44 Weeks-15 Months Maturity. The test table is removed; the child remains sitting on the examining table or crib. The examiner goes to the foot of the table or crib and rolls the ball to the child, assisting him to grasp it if necessary. The examiner then holds out his hands and asks the child to throw the ball. He may take it and roll it away from the child and back again once or twice to induce responsive release.

18-36 Months Maturity. The child has just been given an opportunity to name the ball. He is given the ball and his table is moved aside so that he is free to get up and walk around. The examiner holds out his hands and says, *"Throw it."* It sometimes helps if the examiner squats down to the child's level.

40 DIRECTIONS WITH BALL

18-30 Months Maturity. The examiner secures the child's attention, gives him the ball saying, *"Put it on the CHAIR."* The request may be repeated several times, but an incorrect response is accepted with *"Good."* Secure the ball again, and give it to the child saying, *"Put it on the TABLE."* Then, warning the mother not to hold out her hands, *"Give it to MOTHER,"* then *"Give it to ME." "Thank you."*

41 | BALL IN BOX

18-21 Months Maturity. The examiner holds the performance box upright on the floor, tipping the open end toward the child and invites him to throw the ball in. *"Can you get it?" "Get it out."* Safeguard the child when he leans into the box, when he lifts it and sets it down, when he pulls it over. He may be recalled to the task if he abandons it. No verbal help is given. If he is unsuccessful, the examiner gets it for him.

[*Note:* A very tall child can reach the ball, invalidating the situation.]

42 | PREPOSITIONS WITH BALL

36 Months Maturity. The child has just thrown the ball. The examiner takes the ball and gives it to the child saying, *"Put it ON the chair."* Then *"Put it UNDER the chair."* An incorrect response is accepted.

43 | KICKING

18-36 Months Maturity. The small ball is removed and the large ball handed to the child. After he has thrown it once or twice, it is placed on the floor before him and he is asked to *"Kick it," "Give it a good kick."* The examiner may take the hand of a younger child if he does not respond, and repeat the request. If he responds with the hand held, release his hand and repeat the request. The examiner may also demonstrate kicking if the child does not respond.

[*Note:* The child should be in the center of the room so that he cannot hold wall or furniture to steady himself.]

44 | MIRROR

24-56 Weeks Maturity. The infant is sitting on the examining table or crib. He is turned around to face the mirror and the roller shade is lifted, or the mirror may simply be held in front of him. He should sit very close to the mirror. If he stares at his feet or the image of his feet, the examiner may tap the glass to call his attention to his image.

45 | MIRROR AND BALL

36-56 Weeks Maturity. While the infant is looking in the mirror he is given the small ball to hold in his hand and exploit.

46 | STANDING SUPPORTED

4-32 Weeks Maturity. The infant has been sitting, supported by a hand on either side of the chest. The examiner now lifts the infant to the standing position, holding him securely under the arms. He releases his support slightly to ascertain the infant's participation in the standing act. At *32 weeks,* the examiner may shift his hands, one at a time, and hold the infant by the hands.

47 PRONE

4-24 Weeks Maturity. The examiner has been holding the infant standing. Holding the infant at the shoulder, the examiner now adjusts his hands so that his right hand is under the infant's right arm, the left under the left. Suspend the infant horizontally (face down) over the table or crib and lower him to the platform. As he is placed on the platform, adjust the infant's arms if necessary so they are not caught under his chest or extended footward. If the infant does not lift his head, the examiner takes the head between his hands and gently turns it so that the infant's face rests on the table. If the head lifts, dangle a lure (tricolored rings or catbells) before his eyes, lifting them to induce optimal head lifting. Do not prolong this posture if there is any protest.

At this age range, this situation concludes the examination.

28-32 Weeks Maturity. The infant is placed in the prone position on the examining table or crib platform. Dangle a lure (tricolored rings or catbells) before his eyes, lifting them to induce optimal head lifting. Then put the lure on the platform just out of reach at the side; as the infant pivots keep the lure just out of reach. Try one side then the other. When the infant has exhibited his abilities in prone, reward him with the lure.

At this age range this situation concludes the examination.

Free Postural Situations

[*Note:* After 15 months the free postural tests are so free as to be incidental rather than formally imposed. During the interview the child may have demonstrated most of his gross motor capacities. Standing on one foot (54) is an exception to this rule. If the infant of 36-56 weeks of age is in a play pen during the interview, probably he will also demonstrate most of his locomotor abilities and they need not be formally elicited. Prior to the examination (4-56 weeks) the infant's shoes and stockings are removed. From 15-36 months he keeps them on.]

48 SITTING

36-56 Weeks Maturity. The child sits on the examining table or crib platform. After his sitting posture has been observed, place the lure on the platform before him, just out of reach. Observe his ability either to lean forward and re-erect himself, or to go over to the prone position.

15-36 Months Maturity. The child's ability to seat himself in an ordinary kindergarten chair and to get up again are noted, either at the beginning of the examination, or opportunistically.

49 | CREEPING

36-56 Weeks Maturity. The infant is either placed in prone or has attained the prone position himself. Using a lure (tricolored rings or catbells) try to induce forward locomotion.

50 | RAIL

36-56 Weeks Maturity. The child is placed seated facing the play pen rail or crib rail. The examiner dangles a lure at the top of the rail, out of reach, to induce the standing position. If necessary place the infant's hands on the rail; the mother may dangle the lure and call him. If he is unable to pull to his feet at the rail, place him standing so that he may hold the rail.

51 | CRUISING

36-56 Weeks Maturity. While the infant is standing holding the rail of play pen or crib, dangle the lure just out of reach and to the side. If the infant steps sideward, keep the lure out of reach. Try one side then the other. When his cruising ability has been observed, place the lure down on the floor of the play pen or platform of crib and observe the infant's efforts to lower himself to sitting again.

52 | WALKING SUPPORTED

36-56 Weeks Maturity. The examiner takes the infant's hands, tries to induce him to walk. Many infants will perform better if allowed on the floor at this time; some will do better if the mother holds the hands. If he walks when both hands are supported, try releasing one hand.

At this age range this concludes the examination.

53 | WALKING, RUNNING

15-36 Months Maturity. Incidentally observed during the interview or Small Ball Situations.

At *15-24 months* this concludes the examination.

54 | STAND ON ONE FOOT

30-36 Months Maturity. Lead the child to the center of the room so that he cannot hold wall or furniture for support. Stand facing the child and say, *"Stand on one foot like this." "Pick up your foot."* The examiner demonstrates and encourages, *"That's the way! Keep it up."* When the child lifts his foot, the examiner may time the performance in an approximate way by counting *"1-2-3"* at about the rate of one per second.

At *30-36 months* this concludes the examination.

§ 5. RECORD FORMS

The recording of an examination usually embraces three steps: (a) the interview, (b) the scoring, (c) the appraisal.

Herewith are presented specimens of the blank forms which are used for each of the foregoing steps. The technique for the interview has already been amply detailed in Chapter II. Scoring and the appraisal are discussed in the following section (§ 6). The preliminary inventory is explained and illustrated in § 7 of this Appendix.

The forms themselves, therefore, need little elucidation. Penciled jottings can be entered on the interview form (p. 399) while the interview is in progress. An example of an actual record was given on page 100.

On the developmental schedules two columns are available for scoring purposes. The column immediately adjacent to the behavior item carries a plus (+), minus (−) or double plus sign (++) as will be explained in the next section (§ 6). The parallel column may be used at the examiner's discretion, for conventional signs which he may adopt to shade his scores or to indicate qualitative characteristics.

The summary characterization form is serviceable both as a summary for filing and as a work sheet. The grid obliges the recorder to establish a key age from which he reckons and graphs the ratings for the several fields of behavior, as illustrated in Chapter VII (page 126). Examples of characteristic performance may be entered with an estimate of developmental level in a space provided for the purpose. With the aid of these various entries, the examiner is in a good position to formulate an appraisal (and recommendations).

Both the summary form and the behavior inventory sheet carry a blank space for characterization. Terse, graphic characterizations of demeanor and distinctive behavior features, will serve to visualize the individuality of the child and will prove useful for follow-up and supervisory examinations.

BEHAVIOR INTERVIEW

Name_ _____Age____Date_____CASE No.——

Informant: Duration of foster placement:

    Relationship to child:

Motor behavior (include handedness and manner of manipulation
    of objects)

Language behavior (include gestures)

Play behavior (include toys)

Domestic behavior (feeding, dressing, toilet, co-operation)

Emotional behavior (dependency, management, playmates, specific
    behavior deviations)

Health history

DEVELOPMENTAL SCHEDULES

	24 weeks	Key Age: 28 weeks	32 weeks
Name		Age	Case No.
			Date
Motor	Su: lifts legs high in ext. Su: rolls to prone P. Sit: lifts head, assists (*40w) Sit. chair: trunk erect (*36w) Cube: grasps, palmarwise (*36w) Ra: retains	Su: lifts head (*40w) Sit: briefly, leans fwd. (on hands) Sit: erect momentarily (*32w) St: large fraction of weight (*36w) St: bounces actively (*32w) Cube: radial palmar grasp (*36w) Pellet: rakes (whole hand), contacts (*32w)	Sit: 1 min., erect, unsteady (*36w) St: maintains briefly, hands held (*36w) Pr: pivots (*40w) Pellet: radial raking (*36w) Pellet: unsuccessful inferior scissors grasp (*36w)
Adaptive	D. Ring, Ra, Cube, Bell: approaches & grasps Ra: prehen. pursuit dropt Ra Cube: regards 3rd cube immediately Cube, Bell: to mouth (*18m) Cube: resecures dropt cube M. Cubes: holds 1, approaches another	Ra, Bell: 1 hand approach & grasp M. Cubes: holds 1, grasps another Cube: holds 2 more than momentarily Bell: bangs (*40w) Ra: shakes definitely D. Ring, Cube: transfers Bell: transfers adeptly Bell: retains	Cube: grasps 2nd cube Cube: retains 2 as 3rd presented Cube: holds 2 prolongedly Cup-cu: holds cube, regards cup Ring-str: secures ring
Language	Bell-r: turns head to bell Vo: grunts, growls (*36w) Vo: spontan. vocal–social (incl. toys)	Vo: m-m-m (crying) (*40w) Vo: polysyllabic vowel sounds (*36w)	Vo: single syllable as da, ba, ka
Personal-Social	So: discriminates strangers Play: grasps foot (supine) (*36w) Play: sits propped 30 min. (*40w) Mirror: smiles and vocalizes	Feeding: takes solids well Play: with feet to mouth (supine) (*36w) Mirror: reaches, pats image Ring-str: fusses or abandons effort (*32w)	Play: bites, chews toys (*18m) Play: reaches persistently for toys out of reach (*40w) Ring-str: persistent

SUMMARY CHARACTERIZATION AND APPRAISAL SHEET

Name	Birth date	Date	Exam. No.	Case No.
	Age	Recorder	Examiner	

Physical deviations: Laterality:
Social deviations:
Behavior deviations:

File items:
Classification: .   Follow-up:

<div align="center">Key Age*</div>

Motor				
Adaptive				
Language				
Personal-Social				
General Outlook				

In graphing the maturity ratings, assign a key age to the heavy middle meridian. Assign adjacent ages to adjacent meridians.

Characteristic performance:

LEVEL

_____	Motor
_____	Adaptive
_____	Language
_____	Personal-Social
_____	
_____	

General summary and characterization:

PRELIMINARY BEHAVIOR INVENTORY

Name   Age   Date   Case No.

Age / Zone	MOTOR	ADAPTIVE	LANGUAGE	PERSONAL-SOCIAL
4 wks.	Lacks head control	Brief eye following	Impassive face	Stares at surroundings
Zone	Asymmetric in supine	Drops toy immediately	Small throaty sounds	Listens to sound
16 wks.	Head erect, slight bobbing	Incipient approach, rattle	Coos	Spontaneous social smile
Zone	Symmetric supine postures	Regards rattle in hand	Laughs aloud	Hand play
28 wks.	Sits, leaning forward	Reaches & grasps toy	Squeals	Feet to mouth
Zone		Transfers toy	M-m sound (crying)	
40 wks.	Sits well, creeps	Combines 2 toys	Dada-Mama	Nursery tricks
Zone	Pulls to feet at rail	Picks pellet, thumb & index	One other word	Feeds self cracker
52 wks.	Walks, one hand held	Cube into cup	Two other words	Co-operates in dressing
Zone		Tries tower 2 cubes	Responds "Give it to me"	
15 mos.	Walks alone, toddles	Tower, two cubes	4–6 words	Points & vocalizes wants
Zone		Six cubes into cup		Casts toys
18 mos.	Walks well alone	Tower 3–4 cubes	10 words	Toilet regulated, day
Zone	Seats self small chair	Imitates a stroke	Jargon	Carries, hugs doll
2 yrs.	Runs	Tower 6–7 cubes	Joins 2–3 words	Asks for toilet, day
Zone	Up, down stairs alone	Imitates circular scribble	Names 3–5 pictures	Puts doll to bed, etc.
3 yrs.	Rides tricycle	Imitates house of cubes	Sentences	Feeds self well
Zone	Stands 1 foot, momentarily	Imitates cross	Gives full name, sex	Puts on sox, unbuttons

INSTRUCTIONS: (1) Check the most advanced behaviors in *each field of behavior*. (2) The checks will indicate an *approximate* maturity age zone. (3) *NO DIAGNOSIS CAN BE MADE ON THE BASIS OF THIS INVENTORY*. Gross deviation from actual age, or marked disparity between behavior fields indicates the need for a diagnostic behavior examination.

CHARACTERIZATION: (physical factors, social factors, posture, attention, rapport, emotion, speech, etc.)

§ 6. Scoring and Appraisal

There are several possible methods of recording an examination. Under the ideal arrangements described in Appendix C a recording secretary sits concealed behind a one-way-vision screen. For the age range from 4 to 56 weeks the child's behavior is dictated to her; from 15 to 36 months the secretary records the behavior by direct observation. Lacking such facilities, the examiner may make brief notes during the course of the examination, although this is apt to disturb the flow of the infant's behavior. It is far better if the examiner can train himself to retain a vivid memory picture of what the infant does, and record it immediately after the examination first by checking the appropriate Developmental Schedule and then by making descriptive notes and comments on the reverse blank side of the schedule form.

No matter how the examination is recorded, the child's performance is always scored on the Developmental Schedules. The examiner's first impression of the child is formed when he first sees the child. The interview may alter the first impression somewhat; the child's performance on examination may alter it still further. But it is still only an impression, an approximation. The examiner makes use of this clinical impression, however, in selecting the appropriate Developmental Schedule for scoring. He does not need to keep all the age levels in mind; if he thinks in terms of KEY AGES he immediately says to himself, This child is best booked in terms of 16 weeks— or 40 weeks—or 2 years, whatever the case may be.

Having selected a schedule, the examiner is ready to check the behavior items it carries, in terms of the child's performance. At this point the examiner must remember that there are two types of behavior pattern: *permanent* patterns and *temporary* patterns. Temporary patterns are patterns which transform or are replaced by different and more advanced patterns at later ages. Temporary patterns are indicated on the schedules by an asterisk; the age at which the pattern is replaced by a more advanced pattern is also given.

In scoring, any behavior pattern on the schedule which was adequately performed by the child is checked with a plus sign (+).

When, however, a behavior pattern on the schedule is not represented in the child's behavior, the examiner must pause. If dealing with a permanent pattern (no asterisk) check with a minus sign (−). If dealing with a temporary pattern, consider the possibility that the child may be displaying more advanced, superseding behavior instead. If this is true, check with a double plus sign (+ +); if this is not the case, check with a minus sign (−).

Thus a + sign against any pattern on the schedule means that the child displayed the pattern; a + + sign means he displayed a more mature pattern instead; a − sign means that he is not yet mature enough with respect to that particular pattern to display the pattern. By this device we preserve the fundamental connotation of the minus sign. And for the novice's encouragement, it may be added that with any familiarity at all with developmental sequences, and with a little practice, scoring becomes automatic.

To recapitulate.

1. On the basis of his modified first impression, the examiner selects the Developmental Schedule carrying the most appropriate KEY AGE for scoring.

2. He enters a + sign whenever the child demonstrates the behavior pattern. Some + signs are entered on the basis of a reliable report by the mother of the presence of the behavior pattern in the child.

3. He enters a + + sign whenever the child fails to display a temporary pattern *because he has displayed a more mature pattern instead.*

4. He enters a − sign whenever the child fails to display a permanent pattern, and whenever he fails to display a temporary pattern *because he displayed less mature patterns instead.*

5. The examiner is now ready to make an appraisal of the child's behavior equipment and maturity.

The Developmental Schedule is used to list the presence and absence of significant behavior. We prefer to say presence and absence rather than success or failure because fundamentally we are concerned with status and not with success. There are no right or wrong responses; any response is appropriate to some age level whether or not it is appropriate to the stimulus from an adult's point of view.

The young infant mouths the bell, the older infant rings it; both responses are equally correct and appropriate for their respective age zones.

When we list the presence and absence of behavior patterns, we do not censor the child's behavior, we judge it. From the standpoint of developmental diagnosis, the significance of plus and minus signs is always relative rather than absolute; the final estimate of developmental status is based on the *distribution* of plus and minus signs. For this reason we do not sum and average the signs: it is the total clinical picture which is significant. It is appraised by the simple process of determining how well a child's behavior fits one age level constellation rather than another.

In any field of behavior the child's maturity level is at that point where the aggregate of + signs changes to an aggregate of − signs. If the + and − signs are so irregularly distributed that this point of change becomes a band or zone of change, the maturity level must be thought of as a zone with a basal level. A compromise value is not derived; the facts are better expressed by a formula such as *Adaptive Behavior 28-32 + weeks.* The + sign just used suggests how the evaluation of behavior can be shaded descriptively to indicate a performance "a little better than" or to indicate a superior or inferior quality in performance.

In appraising maturity the examiner must also undertake to explain or at least give weight to discrepancies—behavior patterns seriously out of line with the child's total behavior equipment. He must take into account factors that might influence the behavior responses; illness, fatigue, apprehension, insecurity, unhappiness, visual and hearing defects, motor handicaps, personality deviations, language difficulties, etc. The child is always interpreted in terms of his age, his personality, his experiences, his equipment, and his environment. An appraisal of this penetrating kind tells much more than his maturity status; it sums up his personality characteristics, the integrity of his organization, and his latent and realized potentialities.

§ 7. BEHAVIOR INVENTORY

The physician with a developmental point of view and an interest in problems of maturity has an eye for the symptoms of maturity.

He may develop considerable skill in estimating a child's probable age by the manner in which the child reacts. The subjective impressions of the physician, however, are not always reliable. They may be based too largely on the child's postural control and motor abilities; they may be deceptively colored by the child's general appearance and demeanor. Ordinarily the impressions are so incidental and casual that they do not even become part of the case record. Not infrequently there is subsequent regret that no note was made of behavior capacities when such information would prove useful in the interpretation of later conditions.

This state of affairs suggests the desirability of a simple routine behavior inventory for all cases under supervision and for all hospital cases. A minimal inventory which can be made in a few minutes of time is illustrated herewith.

This schedule is so simply constructed that it requires no more than several check marks for the maturity items listed for nine age zones from 4 weeks through 3 years. There are one or two items for each of the four major fields of behavior in each maturity zone. Evidence for these items is secured by incidental observation, by report, and by the application of a few simple tests. No elaborate procedures are required; no materials other than a convenient toy object, a rattle, a half dozen cubes, a pellet, a cup, and a drawing crayon.

The application of the inventory to an actual case is shown in the accompanying specimen record. The behavior items descriptive of a boy 20 months old were ascertained. The most advanced behavior in the four behavior fields was checked ($\sqrt{}$) and limiting failures in each field were indicated by a minus sign ($-$). Brief notes under the heading *Characterization* add further data. This report suggests a serious degree of retardation which calls for a developmental diagnosis.

Needless to say an inventory is only approximate in its accuracy. It indicates age zones, rather than precise maturity levels. It is in no sense a formal examination nor a substitute for an examination; but it is a selective, screening device which will serve to indicate those cases which do need a formal developmental examination and watchful oversight.

PRELIMINARY BEHAVIOR INVENTORY

Name John Doe   Age 20 mos.   Date 7/20/-   Case No. 00

Age / Zone	MOTOR	ADAPTIVE	LANGUAGE	PERSONAL-SOCIAL
4 wks.	Lacks head control	Brief eye following	Impassive face	Stares at surroundings
16 wks.	Asymmetric in supine	Drops toy immediately	Small throaty sounds	'Listens' to sound
	Head erect, slight bobbing	Incipient approach, rattle	Coos	Spontaneous social smile
28 wks.	Symmetric supine postures	Regards rattle in hand	Laughs aloud	Hand play
	Sits, leaning forward	Reaches & grasps toy	Squeals	Feet to mouth
40 wks.		Transfers toy	M-m sound (crying)	
	Sits well, creeps	Combines 2 toys	Dada-Mama	Nursery tricks
52 wks.	Pulls to feet at rail ✓	Picks pellet, thumb & index	One other word ✓	Feeds self cracker ✓
	Walks, one hand held ✓	Cube into cup ✓	Two other words —	Co-operates in dressing ✓
15 mos.		Tries tower 2 cubes ✓	Responds "Give it to me" ✓	
	Walks alone, toddles —	Tower, two cubes —	4–6 words	Points & vocalizes wants ?
18 mos.		Six cubes into cup		Casts toys
	Walks well alone	Tower 3–4 cubes	10 words	Toilet regulated, day
2 yrs.	Seats self small chair	Imitates a stroke	Jargon	Carries, hugs doll
	Runs	Tower 6–7 cubes	Joins 2–3 words	Asks for toilet, day
3 yrs.	Up, down stairs alone	Imitates circular scribble	Names 3–5 pictures	Puts doll to bed, etc.
	Rides tricycle	Imitates 'house' of cubes	Sentences	Feeds self well
	Stands 1 foot, momentarily	Imitates cross	Gives full name, sex	Puts on sox, unbuttons

INSTRUCTIONS: (1) Check the most advanced behaviors in each field of behavior. (2) The checks will indicate an *approximate* maturity age zone. (3) NO DIAGNOSIS CAN BE MADE ON THE BASIS OF THIS INVENTORY. Gross deviation from actual age, or marked disparity between behavior fields indicates the need for a diagnostic behavior examination.

CHARACTERIZATION: (physical factors, social factors, posture, attention, rapport, emotion, speech, etc.)

Undersized for age. Jolly and friendly. Performs slowly. Complaint: "Backward in speech." Has 2 older normal brothers. Good home conditions. No behavior difficulties, except failure to respond to toilet training. Needs diagnostic examination.

In the hands of a private practitioner who sees his cases from time to time, repeated inventories will take on increasing diagnostic value. They have importance for presumably normal children as well as for children who present defects and deviations. If in later months or years a given child develops convulsions or suffers from disease or accident to the nervous system, even the bare but recorded check marks of the behavior inventory may take on clinical significance and at times even medicolegal significance.

In making the inventory it is important to cover *all* of the fields of behavior, and to note whether there is great disparity between the four fields, with scatter over a wide range of ages. If the check marks gravitate consistently to an age zone which is one full interval below the chronological age of the child, some degree of retardation is indicated. Each schedule carries a blank space for comment and supplementary observations. These observations may cover emotional characteristics, a brief characterization of atypical behavior and any unusual behavior events. When the supplementary comment space is carefully utilized for questions as well as observations, the inventory best serves its preliminary function. It will call timely attention to symptoms, defects, and deviations which require special study.

If the use of the inventory proves productive in his hands, the physician may feel encouraged to undertake some of this special study himself, widening the scope of his inquiries and making formal developmental examinations. The function of the behavior inventory is preliminary. The function of a developmental behavior examination is to define a diagnosis.

§ 8. TABLE OF TEMPORARY BEHAVIOR PATTERNS

In estimating the developmental significance of any given behavior, it is necessary to know whether the behavior is a permanent part of the child's equipment, whether it is undergoing augmentation, or whether it is altering its form and will be replaced. This requires us to recognize two types of patterns, conveniently known as *permanent* and *temporary*. A *temporary pattern* (designated by an asterisk on the Developmental Schedules) is replaced by a more mature pattern of the same nature at a later age (also indicated

on the schedules). E.g., radial raking of the pellet at 32 weeks is superseded by scissors grasp of the pellet at 36 weeks. A permanent item once in the behavior picture stays in or augments. E.g., a child builds a tower of two at 15 months; a tower of three, at 18 months.

For convenience of reference and for comparative study it is desirable to have a complete syllabus of the temporary patterns and the patterns which replace them at successive ages. Such a syllabus follows. The counterpart items are listed in parallel columns side by side, classified both by age and by behavior category. The age of replacement is indicated. A temporary pattern, of course, may be replaced by another temporary pattern or finally by a permanent pattern.

For a further visualization of these items and their developmental transformations at various ages, the student may profitably examine the comprehensive *Growth Trend Chart* in Appendix B.

TEMPORARY PATTERN	REPLACEMENT PATTERN
Motor 4 WEEKS	
Su: side position head predominates......	Head predominantly half side—12 wks.
Su: t-n-r postures predominate..........	Symmetric postures predominate—16 wks.
Su: rolls partway to side...............	Back flat, no rolling—8 wks.
P. Sit: complete or marked head lag.....	Moderate head lag—8 wks.
Sit: head predominantly sags...........	Head predom. bobbingly erect—8wks.
Pr: head droops, ventral suspension......	Head compensates, vent. susp.—8 wks.
Pr: (placement) head rotates...........	Head in midposition—8 wks.
Pr: crawling movements................	Head up, legs flexed, ext. rot., no crawling —8 wks.
Su: both hands fisted..................	Hands open or loosely closed—12 wks.
Ra: hand clenches on contact..........	Rattle placed with ease—8 wks.
Adaptive	
D. Ring, Ra: regards in line vision only..	Delayed midline regard—8 wks.
Ra: drops immediately................	Retains briefly—8 wks.
Bell–r: attends, activity diminishes.......	Turns head to bell—24 wks.
Language	
Express: impassive face................	Alert expression—8 wks.
Express: vague, indirect regard..........	Direct, definite regard—8 wks.
Vo: small, throaty noises..............	Single vowel sounds, ah-eh-uh—8 wks.
Personal-Social	
So: regards Ex. face, activity diminishes ..	Facial social response—8 wks.
Su: stares indefinitely at surroundings....	Regards Ex.—8 wks.
Feeding: 2 night feedings..............	1 night feeding—8 wks.

TEMPORARY PATTERN   REPLACEMENT PATTERN

8 WEEKS

Motor

Sit: head bobbingly erect............... Head steady, set forward—16 wks.
Pr: lifts head Zone II, recurrently....... Head Zone II, sustained—12 wks.

Adaptive

D. Ring: delayed midline regard........ Prompt midline regard—12 wks.
Bell–r: facial response................. Turns head to bell—24 wks.

Language

Vo: single vowel sounds, ah-eh, uh....... Incipient jargon, words—56 wks.

Personal-Social

Feeding: only 1 night feeding........... No night feeding—28 wks.

12 WEEKS

Motor

Su: head predom. half side............ Midposition head predominates—16 wks
Sit: head set forward, bobs............ Head steady, set forward—16 wks.
St: lifts foot....................... .. Feet on platform, sustained—24 wks.
Pr: on forearms...................... Arms extend, on hands—20 wks.
Pr: hips low, (legs flexed).............. Creeps, pelvis elevated—40 wks.

Language

Vo: coos........................... Dada—36 wks.

Personal-Social

Play: hand regard.................... Grasps foot—24 wks.
Play: pulls at dress.................. Prefers toys—24 wks.

16 WEEKS

Motor

Su: hands engage.................... Foot play—24 wks.
Sit: head steady, set forward........... Head erect, steady—20 wks.
Pr: legs extended or semi-extended...... Creeps, legs flexed—40 wks.
Pr: verge of rolling............ .... Stable position, arms extended—20 wks.

Su: fingers, scratches, clutches.......... Grasps on visual cue—24 wks.

Adaptive

D. Ring, Ra, Cube Cup: arms activate... Direct approach—24 wks.
D. Ring: free hand to midline.......... Transfers—28 wks.
Cube, Cup: looks from hand to object.... Hand on object—20 wks.

Language

Express: excites, breathes heavily, strains . Competence and facility in grasp—32 wks

Personal-Social

So: vocalizes or smiles pulled to sit....... Effort to maintain sitting—24 wks.
Play: sits propped 10–15 min........... Sits alone indefinitely—40 wks.
Play: hand play, mutual fingering. ..... Grasps foot—24 wks.
Play: dress over face.................. Prefers toys—24 wks.

TEMPORARY PATTERN   REPLACEMENT PATTERN

20 WEEKS

Motor

Pr or TT: scratches TT or platform . . . . .   Requires toys—28 wks.
Cube: precarious grasp. . . . .   Palmar grasp—24 wks.

Adaptive

Ra, Bell: two hand approach. . . . .   One hand approach—28 wks.
Ra, D. Ring: grasps near hand only. . . . . .   Approaches and grasps—24 wks.
M. Cubes: grasps one on contact. . . . .   Grasps on visual cue—24 wks.

Language

Vo: squeals. . . . .   Dada—36 wks.

Personal-Social

Feeding: pats bottle. . . . .   Holds bottle—36 wks.

24 WEEKS

Motor

P. Sit: lifts head, assists. . . . .   Attains sitting independently—40 wks.
Sit chair: trunk erect. . . . .   Sits independently—36 wks.

Cube: grasps, palmarwise. . . . .   Radial digital grasp—36 wks.

Adaptive

Cube, Bell: to mouth. . . . .   Habitual inhibition—18 mos.

Language

Vo: growls, grunts. . . . .   Dada—36 wks.

Personal-Social

Play: grasps foot (supine). . . . .   Sits, prefers toys—36 wks.
Play: sits propped 30 min. . . . .   Sits indefinitely unsupported—40 wks.

28 WEEKS

Motor

Su· lifts head. . . . .   Attains sitting—40 wks.
Sit: briefly, leans forward (on hands). . . . .   1 minute, erect unsteady—32 wks.
St: large fraction weight (trunk supported)   Briefly, hands held—32 wks.
St: bounces actively. . . . .   Maintains wt. briefly, hands held—32 wks

Cube: radial palmar grasp. . . . .   Radial digital grasp—36 wks.
Pellet: rakes, whole hand contacts. . . . . . .   Unsuccessful inferior scissors grasp—32 wks

Adaptive

Bell: bangs. . . . .   Waves, shakes—40 wks.

Language

Vo: m-m-m (crying). . . . .   Mama—40 wks.
Vo: polysyllabic vowel sounds. . . . .   Dada—36 wks.

Personal-Social

Play: with feet, to mouth (supine). . . . . . .   Sits and prefers toys—36 wks.
Ring-str: fusses or abandons effort. . . . . . .   Persistent—32 wks.

TEMPORARY PATTERN   REPLACEMENT PATTERN

32 WEEKS

Motor

Sit: 1 minute, erect, unsteady... ... ...   Steady, 10 min.—36 wks.
St.: maintains briefly, hands held ..   ..   Stands holding rail—36 wks.
Pr: pivots..................... .. . .   Creeps—40 wks.
Pellet: radial raking........... ....   Prehends, scissors grasp—36 wks.
Pellet: unsuccessful inferior scissors grasp .   Prehends, scissors grasp—36 wks.

Personal-Social

Play: bites, chews toys................   Habitual inhibition mouthing—18 mos.
Play: reaches persistently toys out of reach.   Insight, creeps to toy—40 wks.

36 WEEKS

Motor

Pellet: prehends, scissors grasp.. ....   Inferior pincer grasp—40 wks.

Adaptive

Cube: grasps third cube... . ...   Retains two, exploits 3rd with cubes in hand—40 wks.
Cube: hits, pushes cube with cube.... ..   Builds tower or casts—15 mos.
Cup & cu: cube against cup....... ....   Cube into cup without release—44 wks.

Pellet & bo: approaches bottle first . . ..   Approaches pellet first—40 wks.

Personal-Social

Feeding: holds bottle.......... ....   Bottle discarded—15 mos.

40 WEEKS

Motor

St: pulls to feet at rail........ . ...   Attains standing independently—15 mos.
Pr: creeps..........................   Walks alone, creeping discarded—15 mos.
Cube: crude release................ ..   Controlled release (tower, casting)15 mos.
Pellet: inferior pincer grasp..... ....   Neat pincer grasp—48 wks.

Adaptive

Cube: matches two cubes..............   Tower of 2 cubes—15 mos.

Personal-Social

So: waves bye and patacakes. ....   Too sophisticated . . .

44 WEEKS

Motor

St: (at rail) lifts, replaces foot.. ....   Walks, two hands held—48 wks.

Adaptive

Cup & cu: (dem.) cube into cup without
  release.............................   Releases cube in cup—52 wks.
Pellet in bo: points at pellet thru glass....   Dumps pellet out—18 mos.

Personal-Social

So: extends toy to person without release .   Gives toy—52 wks.
Mirror: reaches image ball............   Applies ball to mirror—52 wks

TEMPORARY PATTERN	REPLACEMENT PATTERN

48 WEEKS

Motor

St: cruises at rail.....................	Walks alone—15 mos.
Walks: needs both hands held...........	Needs only one hand held—52 wks.

Adaptive

Cube: sequential play.................	Builds buildings—48 mos.
Pellet & bo: takes pellet only...........	Steadies bottle—56 wks.

Personal-Social

Play: toys to side rail...................	Casts to floor—15 mos.
Play: platform play....................	Over rail or on table—52 wks.

52 WEEKS

Motor

Walks: needs only one hand held........	Walks alone—15 mos.

Adaptive

Cube: (dem.) tries tower, fails...........	Tower of 2—15 mos.
Cup & cu: (dem.) releases one cube in cup	(No dem.) releases cube in cup—56 wks.
Pellet & bo: tries insert, releases, fails.....	Inserts pellet in bottle—15 mos.

Personal-Social

Dressing: co-operates in dressing........	Dresses, undresses, supervision—48 mos.

56 WEEKS

Adaptive

Formbd: (dem.) inserts round block......	(No dem.) inserts round block—15 mos.

Language

Vo: incipient jargon...................	Jargon discarded; sentences—24 mos.

Personal-Social

Ball: releases with slight cast toward Ex...	Hurls ball—18 mos.

15 MONTHS

Motor

Walks: falls by collapse................	Seldom falls—18 mos.
Stairs: creeps up......................	Walks up, one hand held—18 mos.
Book: helps turn pages.................	Turns 2–3 at once—18 mos.

Adaptive

Cup & cu: 6 in and out cup.............	10 into cup, out inhibited—18 mos.
Drawing: incipient imitation stroke......	Definitive stroke imitation—18 mos.

Language

Vo: uses jargon......................	Jargon discarded, sentences—24 mos.
Book: pats pictures...................	Looks selectively, names or points—18 mos.

Personal-Social

Toilet: partial regulation..............	Verbalizes needs fairly consistently—24 mos
Toilet: indicates wet pants.............	Regulated daytime—24 mos.
Communication: indicates wants (points or vocalizes)...........................	Asks for food, toilet, drink—21 mos.
Play: shows or offers toy...............	Pulls person to show—21 mos.
Play: casts object in play or refusal.......	Inhibits, plays on table—18mos.

Temporary Pattern	Replacement Pattern

18 MONTHS

Motor

Walks: fast, runs stiffly................	Runs well—24 mos.
Stairs: walks up, one hand held.........	Walks up, holds rail—21 mos.
Adult chair: climbs into...............	Sits down in . . .
Ball: hurls...........................	Throws overhand—48 mos.
Large ball: walks into.................	(Dem.) kicks—21 mos.
Book: turns pages, 2–3 at once.........	Turns pages singly—24 mos.

Adaptive

Drawing: scribbles spontaneously.......	Names own drawing—36 mos.
Formboard: piles 3 blocks.............	Places single blocks on—24 mos.

Personal-Social

Feeding: hands empty dish.............	Inhibits . . .
Feeding: feeds self in part, spills........	Feeds self, spills little—36 mos.
Toilet: regulated daytime.............	Verbalizes needs—24 mos.
Play: pulls a toy......................	Pushes a toy—30 mos.
Play: carries or hugs doll...	Domestic mimicry—24 mos.

21 MONTHS

Motor

Walks: squats in play.................	Sits or leans over . . .
Stairs: walks down, one hand held.......	Down alone—24 mos.
Large Ball: (dem.) kicks...............	(No dem.) kicks—24 mos.

Adaptive

Cube: imitates pushing train...........	Aligns 2 or more cubes—24 mos.
Performance box: inserts corner of square.	Inserts square—24 mos.

Language

Speech: combines 2–3 words spontaneously	3 word sentences—24 mos.

Personal-Social

Communication: echoes 2 or more last words	Verbalizes immediate experiences—24 mos.
Communication: pulls person to show....	Asks (for another, etc.)—24 mos.

24 MONTHS

Adaptive

Cube: aligns 2 or more, train...........	Adds chimney—30 mos.
Formboard: places single blocks on......	Inserts 3 blocks on presentation—30 mos
Formboard: adapts after 4 trials........	Adapts repeatedly, error—30 mos.

Personal-Social

Toilet: dry at night, taken up..........	Dry all night—36 mos.
Toilet: verbalizes toilet needs..........	Takes toilet responsibility—42 mos.
Communication: verbalizes immed. exper.	Inhibits . . .
Communication: refers to self by name....	By pronoun—30 mos.
Play: parallel play predominates........	Associative play—42 mos.

TEMPORARY PATTERN	REPLACEMENT PATTERN

30 MONTHS

Adaptive

Drawing: 2 or more strokes for cross...... Imitates cross—36 mos.
Formboard: adapts repreatedly, error.... Adapts, no error—36 mos.

Personal-Social

Communication: repetitive in speech, other
  activities............................ Direction and goal—36 mos.

36 MONTHS

Adaptive

Cube: imitates bridge................. (No dem.) bridge from model—42 mos.
Drawing: imitates cross............... (No dem.) copies cross—48 mos.

§ 9. GLOSSARY OF DEVELOPMENTAL SCHEDULE ITEMS

A full set of the developmental schedules has been presented in Chapter III. The behavior normatively characteristic for the key ages has been described. The test items, therefore, which appear on the schedules are for the most part self-explanatory. The items, however, are briefly worded. The following glossary has been drawn up to clarify abbreviations of statement, and to specify details where needed. For convenience of reference the items are listed by ages in the order in which they appear on the schedules.

4 WEEKS (See Plate I, Chapter III)

Supine: T-n-r postures predominate. The head is everted, the arm toward which the face is directed (face arm) is extended, the other arm (occiput arm) flexed.

Supine: rolls partway to side. Head and trunk. This position may be preferred and the flat supine impossible to maintain.

Sitting: head predominantly sags. Droops forward, chin on chest; may erect momentarily.

Prone: placement, head rotates. As he is placed down in prone, infant turns head to side and rests on cheek.

Prone: lifts head Zone I, momentarily. Head lifts so that face barely clears the table surface, or so that chin is about 1 inch above table surface. The examiner may turn the infant's head to the midline to induce lifting.

Prone: crawling movement. Legs only.

Rattle: hand clenches on contact. The fisted hand fists more tightly when touched by the rattle handle. The hand may later open.

Dangling Ring, Rattle: regards line vision only. The test object is not perceived until it is brought into the direct line of vision at a favorable focal distance.

Rattle: drops immediately. After placement in hand.

Bell-ringing: attends, activity diminishes. Response may be very brief; infant may inhibit respiration momentarily.

Vocalization: small throaty noises. Soft subvocal sounds.

Social: regards examiner's face, activity diminishes. In response to social stimulation. Touching the infant's face is not included in social stimulation.

Feeding: 2 night feedings. After 7 P.M.

8 WEEKS

Prone: head compensates ventral suspension. Head held in line with trunk as infant is lowered into prone position.

Prone: lifts head Zone II recurrently. Chin lifted 2-3 inches above table surface.

Dangling Ring: regards examiner's hand. Examiner's hand holding end of string.

Dangling Ring: follows past midline. Follows ring or examiner's hand; some head rotation usually necessary.

Bell-ringing: facial response. Blink, eye widening, frown, smile, etc.

Social: facial social response. Facial brightening or smiling in response to social stimulation. Do not touch the infant's face to elicit this response.

Supine: regards examiner. Spontaneously and selectively.

12 WEEKS

Supine: head predominantly half side (t-n-r). Head less fully rotated than when younger. T-n-r less stereotyped.

Supine: midposition head and symmetrical postures seen. Chin and nose in line with median line of trunk; arms symmetrically disposed. Posture not predominant but observed.

Sitting: head set forward, bobs. Head erect, but thrust forward and unsteady.

Prone: on forearms. Arms flexed, weight rests on elbows and forearms.

Cup: contacts. During regard for cup.

Dangling Ring: follows 180°. Follows ring or examiner's hand.

Cube, Cup: regards more than momentarily. Examiner may hold head to favor regard.

Vocalization: chuckles. Just short of true laughter. Must be explicitly inquired about.

Social: vocal-social response. Infant vocalizes in some manner or "talks back" in response to social stimulation.

Play: hand regard. In his spontaneous play the infant brings one or both hands before his face for regard.

16 WEEKS (See Plate II, Chapter III)

Prone: Zone III, sustained. Head lifted so that plane of face is vertical to table surface.

Prone: verge of rolling. One arm tends to be extended or semi-extended, the other flexed, the head in Zone III; the infant shows a tendency to roll over his extended arm.

Dangling Ring: retains. During observation period—about 1 minute.

Supine: fingers, scratches, clutches. His own body, or hair, or dress, or he may clutch at examiner's clothes when held at shoulder.

Dangling Ring, Rattle, Cube, Cup: arms activate. During regard for object, infant's arms become active, though they are not necessarily brought nearer the object. Activity may even be confined to tremulous poising. Score if this response is well defined in one or more of the situations listed.

Dangling Ring, Rattle: regards in hand. Sustained regard.

Dangling Ring: free hand to midline. Hand approaches midline; may not reach it.

Table Top: looks down at table top or hands. Spontaneously regards test table surface or own hands on table.

Cube, Cup: looks from hand to object. Or vice versa, back and forth.

Pellet: regards. Any regard that is definite. Examiner is permitted to point to pellet to attract attention to it, to move it about, etc.

Expressive: excites, breathes heavily, strains. During regard for an object.

Social: spontaneous social smile. Infant initiates social play by a beaming smile.

Social: vocalizes or smiles, pulled to sitting. Apparently in response to translocation and new posture. Sometimes almost squeals with delight.

Feeding: anticipates on sight food. Mother reports recognition of bottle on sight; infant becomes excited and eager when sees bottle.

Play: hand play, mutual fingering. Infant brings hands together in spontaneous play; hands finger each other.

20 WEEKS

Prone: arms extended. Forward as props, resting weight on hands.

Cube: precarious grasp. When placed in hand, or on spontaneous grasp. Cube held between tip of finger or fingers, and heel of palm.

Rattle, Dangling Ring: grasps near hand only. Does not approach object in midline, but if object is brought within an inch of hand, hand completes the approach and grasps.

Massed Cubes: grasps 1 on contact. Hand falls upon or contacts a cube without regardful approach, and cube is grasped.

24 WEEKS

Supine: lifts legs high in extension. Or semi-extension. A report that the infant lifts legs high enough to see or grasp feet is accepted.

Cube: grasps palmarwise. Whole hand grasp without radial differentiation. Cube held in palm of hand, fingers closed about it.

Rattle: retains. During period of observation—about 1 minute.

Dangling Ring, Rattle, Cube, Bell: approaches and grasps. Usually a 2-hand approach.

Cube: regards third cube immediately. After presentation. Regard may follow examiner's withdrawing hand, but returns at once to third cube.

Vocalization: spontaneous vocal-social. At 16 weeks the infant initiates social play by smiling; at 24 weeks by smiling and vocalizing. He also "talks" to his toys.

Social: discriminates strangers. Not necessarily fearful; may simply sober and not accept strangers as quickly as familiars.

28 WEEKS (See Plate III, Chapter III)

Supine: lifts head. As though straining to sit up.

Standing: large fraction of weight. Examiner supports infant by trunk.

Cube: radial palmar grasp. Cube held in palm of hand but off center (toward the radial side); the fingers are closed about the cube, the thumb tending to oppose the fingers.

Pellet: rakes (whole hand) contacts. Hand over or near pellet, all fingers flexing in a raking, scratching movement. The thumb moves with the fingers, and acts like a finger. Infant succeeds in touching the pellet.

Cube: holds 2 more than momentarily. Cubes may have been placed in his hands.

Dangling Ring, Cube: transfers. Infant exchanges grasp of object from one hand to the other with expeditious transition.

Vocalization: polysyllabic vowel sounds. An advance over cooing which repeats the same vowel sound; at this stage he vocalizes diverse vowel sounds in varying combinations.

Feeding: takes solids well. Semi-solids.

32 WEEKS

Prone: pivots. Moves in a circular manner, pivoting on abdomen, by co-ordinated action of arms (and legs). The infant should demonstrate his capacity to pivot more than 45°; more than this need not be demanded. The surface should be hard.

Pellet: radial raking. The radial side of the hand is definitely oriented to the pellet and takes the lead in raking at the pellet.

Pellet: unsuccessful inferior scissors grasp. The infant attempts to grasp the pellet by approximating the thumb to the side of the curled index finger; the other fingers have simultaneously flexed.

Cube: retains 2 as third presented. Retains one cube in each hand.

Play: bites, chews toys. An advance over earlier mouthing.

36 WEEKS

Sitting: 10 minutes + steady. Is still apt to throw self back unexpectedly.

Standing: holds rail, full weight. The child must be placed standing at the rail. He·is able to hold on and maintain his position without assistance.

Cube: radial digital grasp. Cube held with ends of thumb and of first and second fingers.

Pellet: prehends, scissors grasp. Successful prehension between thumb and side of curled index finger. The grasp is inferior if the remaining fingers also curl.

Vocalization: imitates sounds. Such as a cough, "razz," clicking of tongue, etc.

Feeding: feeds self cracker. Or zweiback, etc. Successive purposeful bites and munching, rather than simply sucking on the cracker and then discarding it.

40 WEEKS (See Plate IV, Chapter III)

Prone: creeps. On hands and knees, or hands and feet, trunk raised. Pulling self along on abdomen (crawling) is less mature behavior than creeping; pulling self about on buttocks in sitting position (hitching) is a locomotor variant roughly equivalent to creeping in maturity value.

Cube: crude release. As opposed to dropping; a deliberate but somewhat clumsy or exaggerated letting go.

Pellet: inferior pincer grasp. Between thumb and tip of index (or middle) finger, the hand resting on the table surface.

Cube: matches 2 cubes. Brings them into close proximity as though comparing them or brings them together patacake fashion; both cubes are grasped and lifted. (To be differentiated from pushing one cube with another.)

Bell: grasps by handle. Not by bowl *and* handle; initial approach and grasp only.

44 WEEKS

Bell: grasps by top of handle. Over-hand; initial approach only.

Social: extends toy to person without release. In response to extended hand and "Give it to me"—"Thank you."

Mirror: reaches image ball in hand. Infant holds ball in one hand reaches into mirror with free hand for image of ball.

48 WEEKS

Sitting: pivots. Moves in a circular manner, swinging around on buttocks.

Standing: cruises at rail. Sideward walking, holding rail for support, shifting hands.

Walks: needs 2 hands held. Trunk does not need support; child is held by his two hands and moves his legs co-ordinately with a definite forward drive.

Pellet: neat pincer grasp. Between thumb and tip of index (or middle) finger, the hand elevated above the table surface,—an over-hand grasp.

Cube: sequential play. Transposing one after another about on table, or from table to platform, or picking up and dropping one after another, etc.

Play: platform play. Carrying object to platform or exploiting an object on the platform. Does not include simply restoring a dropped object from platform to table.

52 WEEKS (See Plate V, Chapter III)

Cube: (demonstration) tries tower, fails. Tower falls when cube is released, or cube is placed on in tower fashion without release, or tower is built in hand and tower cube held on.

Pellet and bottle: tries insert, releases, fails. Pellet falls outside bottle; it is not necessarily released over neck of bottle but definitely brought into relation with bottle, and released, in response to demonstration, command, or gesture.

Formboard: looks selectively at round hole. Do not score questionable be-havior. The combining by eye shifts of round block and round hole (before the examiner demonstrates the relationship) is very obvious when present.

Comprehension: "gives" a toy (request and gesture). Places and releases in hand. If he is unwilling to respond to the examiner accept a reliable report or let the mother ask the child.

Mirror: ball to mirror. Brings ball against image of ball.

Dressing: co-operates in dressing. Puts foot out for shoe, puts arms through sleeve, etc. May have one or two other tricks such as bringing comb to head or handkerchief to nose.

15 MONTHS

Walks: few steps; starts and stops. More is required than the ability to take a few steps alone. Taking a few tottering steps from one person to another, or from one chair to another, is not sufficient to score this pattern; the child should have enough control so that he can stop and start again without sup-port.

Walks: falls by collapse. Frequent falling is characteristic of early walking; this falling is ordinarily accomplished by sitting down suddenly without losing balance.

Walks: has discarded creeping. This implies that walking is the child's prefer-ential method of locomotion and that if speed or efficiency is desired he will not revert to a more primitive method. Under stress of great fatigue he may, however, still occasionally creep.

Pellet: places in bottle. On command or gesture, or spontaneously. No demon-stration necessary.

Cubes: tower of two. Demonstration—the tower should stand.

Cup and Cubes: six in and out cup. The examiner urges the child to fill the cup and to continue filling rather than emptying the cup. Consecutive cubes may even be offered the child.

Drawing: incipient imitation stroke. This is judged not so much by the product of the crayon as by the movement made by the child in attempting to imi-tate the stroke. He frequently starts to respond strokewise and then scrib-bles instead.

Formboard: places round block. Spontaneously or after command, pointing, or demonstration. Inserts completely.

Formboard: adapts round block promptly. The children who can be interested in this situation will make a prompt, adaptive placement or near-placement of the round block when the formboard is rotated, though it is seldom that the performance is repeated, due to the very brief span of interest at this age.

Book: pats picture. Spontaneously or after examiner has pointed to a picture.

Feeding: has discarded bottle. Includes night bottle.

Toilet: partial toilet regulation. Responds to regular placements on the toilet (not invariably) but does not indicate toilet needs, and does not wait to be taken to toilet if need is not correctly anticipated. Toilet "accidents" are fairly common occurrences.

Toilet: bowel control. Does not indicate toilet needs, but responds to toilet placement at regular hour.

Toilet: indicates wet pants. By squirming, pulling at pants, fussing, etc.

Communication: says "ta-ta" or equivalent. Spontaneously or on giving or receiving an object.

Play: casts objects playfully or in refusal. A very characteristic pattern at this age and one which may interfere with other examination responses. Frequently seen in defective children who are operating at a 15-months-level. It is sometimes necessary to make a careful distinction between true 15 months casting and exaggerated stereotyped release representing atypical hypertrophied 40 weeks behavior.

Play: shows or offers toys to mother or examiner. During the examination.

18 MONTHS (See Plate vi, Chapter iii)

Walks fast: runs stiffly. Either pattern scores. The stiff running is due to the very upright posture that is maintained. Any leaning forward in the direction of the run would result in falling.

Small chair: seats self. Any successful method that involves preliminary standing with back to chair. The child often peers between his legs or turns his head to assure himself that his aim is accurate, or he may squat down a little to one side of the chair and then slide over into position. Straddling the chair is more advanced.

Adult chair: climbs into. The child faces the chair, climbs up, then turns around to sit down.

Ball: hurls. As opposed to dropping with simple cast; it also implies throwing in the standing position. The younger child sits down to play ball.

Large ball: walks into. After demonstration of kicking. He is not permitted to hold wall, adult's hand, etc., for support.

Cubes: tower of three or four. He may need demonstration to begin and urging to continue. The tower should stand.

Cup and Cubes: ten into cup. Spontaneously or with urging and demonstration.

Pellet: dumps responsively. In response to "get it out." Hooking the pellet with the finger (rare) is an equivalent response; shaking it out is more primitive.

Drawing: makes stroke imitatively. The stroke is imitated, without regard to direction. A stroke immediately obliterated by scribbling is a correct response in an over-productive child.

Formboard: piles three. On formboard or table. This is usually the spontaneous performance.

Book: looks selectively. At the pictures. He may not point or name, but when asked, "Where is the dog?", etc., he definitely looks at the dog.

Ball: two directions. Throwing the ball at the chair, table, or mother is acceptable. Seating self on chair, holding ball is not acceptable.

Feeding: feeds self in part, spilling. Means part of the meal without any direct help.

Toilet: regulated, daytime. Responds to regular toilet placements. The responsibility is the mother's but she is able to keep the child dry all day with only rare "accidents." He does not indicate his toilet needs but he will wait a reasonable length of time for an opportunity to use the toilet.

21 MONTHS

Walks: squats in play. Implies sufficient control and balance so that this position can be maintained for several minutes while playing on the floor or ground.

Large ball: kicks on demonstration. Swings leg, foot striking the ball a sharp blow; the child is not permitted to hold onto any support.

Cubes: tower of five-six. May need demonstration to begin and urging to continue. The tower should stand.

Cubes: imitates pushing train. One or more cubes.

Formboard: places two or three. In formboard, at any time during the situation.

Performance box: inserts corner or square. Spontaneously or after demonstration or insertion. Does not completely insert square.

Performance box: retrieves ball from. Any method such as pushing the box over, lifting and tilting the box, creeping into the box after overturning it. If the performance seems highly accidental, repeat. The situation cannot be used with very tall children who are able to reach the ball (rare at 21 months). This is an excellent situation in which to observe the reactions of the individual child in the face of difficulties, his persistence, ingenuity, emotional responses, etc.

Combines two or three words spontaneously. Such combinations as "all gone," "big boy," "oh dear," do not score. "Daddy go," " 'bye mama," "baby bed" are acceptable combinations.

Ball: three directions. Throwing at correct objective is acceptable. Seating self on chair holding the ball is not acceptable.

Feeding: handles cup well, lifting, drinking, replacing. The younger child tilts the cup too far so that he spills profusely; he is also apt to drop or throw the cup when finished drinking.

Communication: asks for food, toilet, drink. By gesture or word.

Communication: echoes two or more last words. That adult has said.

Communication: pulls person to show. For example, taking the mother's hand and leading her to the kitchen sink, as compared with standing at the sink, pointing and vocalizing "uh-uh" at an earlier age.

24 MONTHS (See Plate vii, Chapter iii)

Runs well. Without falling but still not very fast. Balance while hurrying.

Stairs: walks up and down alone. May use banister.

Large ball: kicks. On verbal command without demonstration. The examiner may say, "Kick it with your *foot*."

Cubes: tower of six or seven. May need demonstration to start and urging to continue. Tower should stand.

Cubes: aligns two or more, train. In response to train demonstration.

Formboard: places on board separately. Not necessarily in holes or in relation to correct holes. Usually the spontaneous response.

Formboard: adapts in four trials. To rotation of board. Trial and error or better.

Performance box: inserts square. Spontaneously or after demonstration.

Speech: I, me, and you. Not necessarily correctly.

Picture cards: identifies five or more. By naming or pointing.

Ball: four directions correct. Throwing the ball at the correct objectives is acceptable.

Feeding: inhibits turning of spoon. At least until spoon is in mouth.

Toilet: dry at night if taken up. All night.

Dress: pulls on simple garment. Sox, mittens, pulls up pants.

Communication: verbalizes immediate experiences. Soliloquizes on his activities as he performs them.

Play: plays with domestic mimicry. Puts doll to bed, covers with blankets, pretends to feed, etc.

Play: parallel play predominates. Plays beside another child, often engaging in same activity, but quite separately.

30 MONTHS

Walks: on tiptoe. Demonstration—hand may be held at first.

Jumps: with both feet. In place.

Tries to stand on one foot. The examiner demonstrates, maintaining the pose to encourage the child to do so. The younger child refuses this situation.

Holds crayon by fingers. As opposed to holds in fist.

Cubes: tower of eight. May need demonstration to start and urging to continue. The tower should stand.

Cubes: adds chimney to train. The examiner may ask, "Where is the chimney?"

Drawing: two or more strokes for cross. Score only if response differs from the child's response to stroke demonstration.

Color forms: places one. Round form may be demonstrated.

Formboard: places three blocks on presentation. Spontaneously or in response to "Put them in."

Formboard: adapts repeatedly, error. Usually solved with error on the first rotation, but subsequent trials do not eliminate the error.

Full name. Includes nickname for first name.

Test objects: gives use. Of one or more objects. Liberal scoring, for example: "What do you do with the key?" Answer, "Door," is acceptable.

Communication: refers to self by pronoun rather than by name. May confuse "I" and "me."

Communication: shows repetitiveness in speech and other activities. Makes a remark over and over; tends to want things done always in the same way, —ritualistic.

36 MONTHS (See Plate viii, Chapter iii)

Stairs: alternates feet going up. A foot to a step.

Jumps: from bottom stair. Both feet.

Stands on one foot, momentary balance. The examiner demonstrates and maintains the pose to encourage the child to do so. He may be timed by slow counting.

Cubes: tower of nine (ten on three trials). Tower should stand. May need urging to try again.

Cubes: imitates bridge. Demonstration.

Drawing: names own drawing. Spontaneously, or in response to "What is it?"
Color forms: matches three. Round form may be demonstrated.
Picture book: gives action. In response to question, "What is . . . doing?"
Feeding: pours well from pitcher. Small pitcher.
Dressing: puts on shoes. Not necessarily on correct feet.
Communication: asks questions rhetorically. He knows the answer; often asks
a question because he wishes it to be asked of him.

42 MONTHS

Stands on one foot for 2 seconds. The examiner demonstrates and maintains the
pose to encourage the child to do so. He may be timed by slow counting.
Cubes: builds bridge from model. No demonstration.
Picture cards: names all. Without a specific question for each picture.
Dressing: washes and dries hands or face. Without reminder to dry; washing
or drying may not be very efficient.
Play: associative group play taking place of parallel play. Several children
engage in same activity with frequent cross-reference and comment.

GENERAL NOTE. When a behavior pattern is incidental or merely
incipient it is generally not entitled to a plus rating on the Developmental
Schedules. To earn a plus rating, behavior should be well established as
an organic part of the child's working equipment.

GROWTH TREND CHART

The chart reproduced herewith provides a comprehensive overview of the whole area of development from 4 weeks through 36 months. It is a single integrated chart which exhibits the continuity of the growth trends for this entire period. For convenience, however, the chart is separated into five subdivisions as follows:

First Quarter: 4, 8, 12, 16 weeks
Second Quarter: 16, 20, 24, 28 weeks
Third Quarter: 28, 32, 36, 40 weeks
Fourth Quarter: 40, 44, 48, 52 weeks
Later Infancy: 15, 18, 21, 24, 30, 36 months

All diagnostically significant behavior, including that explored by the interview as well as by the examination is represented in the chart. Behavior normatively characteristic (that is, present in 50 per cent or more of all cases) is shown for all the age levels, both key ages and intermediate ages. The growth trends for any given behavior are readily ascertained by reading horizontally across the chart from age to age. The lines of continuity are represented by serial dots. . . . In the first column of each page the continuity of an earlier item of behavior is indicated by reprinting the item in *italics*. The italics, by convention, therefore are equivalent to serial dots.

Take for example the Cup and Cubes situation. The first normatively significant behavior appears at 32 weeks. The infant holds the cube and regards the cup. At 36 weeks he brings the cube against the cup. At 40 weeks he reaches into the cup and fingers the cube. At 44 weeks he not only fingers but removes the cube from the cup;

he can also put the cube into the cup but without release. At 52 weeks he releases the cube into the cup.

This interesting developmental progression is succinctly summed up on the chart as follows:

32 weeks	*36 weeks*	*40 weeks*	*44 weeks*	*48 weeks*	*52 weeks*
holds cube, regards cup..	brings cube against cup ..	fingers cube in cup.......	fingers cube and removes..............		releases cube into cup

If the reader is curious to follow the genetic trends still further, the chart will show continuations of this patterning of cup-cube behavior at 15, 18, 21, and 24 months.

When any given behavior is no longer significantly present in the examination and is not replaced the termination is designated by a bracket sign].

The chart also serves to visualize and to codify the numerous temporary patterns of behavior which were tabulated in the previous appendix (A). The beginning, the developmental transformation, and the fate of each temporary pattern is shown in horizontal progression.

The chart lists not only the behavior patterns which appear on the developmental schedules but all other patterns of characteristic behavior elicited by the test situations. Although the standard developmental schedules are ample for routine purposes, the systematic organization of the growth trend chart will make it serviceable for detailed analysis of cases which require special study. The chart also serves as a compendium for the student who wishes to become more familiar with the developmental relationships of the behavior characteristics which have diagnostic significance.

A GROWTH TREND CHART for the period of EARLY INFANCY is presented in four sections as follows:

§ 1. First Quarter: 4, 8, 12, 16 weeks

§ 2. Second Quarter: 16, 20, 24, 28 weeks

§ 3. Third Quarter: 28, 32, 36, 40 weeks

§ 4. Fourth Quarter: 40, 44, 48, 52 weeks

§ 1. GROWTH TREND CHART. *FIRST QUARTER: 4-16 WEEKS*

4 Weeks	8 Weeks	12 Weeks	16 Weeks
Supine			
Head side predom.		Head ½ side predom.	Head midl. predom.
T-n-r pos. predom.			T-n-r posit. seen.
Windmill mvts.		H. midl. & sym. postures seen	Sym. postures predom.
Hand to mouth.			Hands engage.
Both hands fisted.		Hands open or loosely cl.	
Legs fl. heels on platf.			Fingers, scratches, clutches.
Legs fl. & ext., sl. lifted.			
Rolls partway to side.			
Impassive face.	Alert face.		
Indirect regard.	Direct regard.		
Stares indef. at surr.	Looks at Ex.	Predominant regard Ex.	Smiles at Ex.
D. Ring			
Regards line vis. only.	Delay reg. midl.	Prompt midl. regard.	
Follows to midl., not beyond.	Follows past midl.	Follows 180°	
	Regards Ex. hand.	Regards Ex. face.	
			Arms activate.
			Regards ring in hand.
			Mouths ring.
			Free hand approaches.
			Retains.
Rattle			
Regards line vision only.		Delay midl. regard.	Prompt midl. regard.
Hand clenches contact.			Arms activate.
Placed with difficulty.	Placed with ease.	Holds actively.	
Drops immediately.	Retains briefly.	Glances at Ra in hand.	Regards Ra in hand.
Drops rattle.			

Bell ring			
Attends, reduced activity	Facial response		Facial response
Social stim.			
Regards Ex., reduct. activ.	Facial soc. resp. / Follows moving person	Vocal social response	Spontaneous soc. smile
Pull-sit			
Complete or marked lag	Moderate lag		Slight lag / Voc. or smiles on att. sit'g.
Sit			
Head sags / Erects head / Head predom. sagging / Back rounded	Head predom. bob. erect	Head set forward / Set fwd., bobbing	Set forward, steady / Lumbar curv. only
Standing			
No weight support / Sl. resist. platform / Legs extend briefly / Curls toes		Small fraction wt. briefly / Legs ext. recurrently / Lifts foot	Rises to toes
Prone			
No head compensation / Head rotated (placement) / Lifts to Zone I moment / Head returns to side / Lowers to platform / Hips high	Head compensation / Head midl. (placement) / Zone II recurrently	Zone II sustained / Hips low	Zone III, sustained

(see next page)

GROWTH TREND CHART. *FIRST QUARTER: 4-16 WEEKS (Continued)*

	4 WEEKS	8 WEEKS	12 WEEKS	16 WEEKS
Prone (Continued)	Kneeling position...... Crawling movements......]	Legs fl., ext, rot......	Rests on forearms, fl......	Legs ext. or semi-ext....... 1 arm fl, 1 ext....... Verge of rolling......
Language	Sm. throaty noises......	Ah-uh-eh...... Smiles......	Coos...... Chuckles......	Laughs...... Breathes heavily, excites......
Interview	2 night feedings...... Startle, sneeze, jaw clonus......]	1 night feeding......	Pull at dress...... Hand regard.	Dress over face...... & play, with mut. fingering... Sits propped 10–15 min...... Antic. on sight food......
Chair			Slumps...... Erects head, nodding...... Regards Ex...... Fingers TT......	Regards TT or hands......
Cube			Follows Ex. withdr. hand...... Reg. own hand...... Reg. cube prol......	Shifts reg. hand to cube...... Reg. cube recurrently...... Arms activate...... Contacts cube......

	16 Weeks	20 Weeks	24 Weeks	28 Weeks
Pellet			Follow Ex. withdr. hand No regard pellet Hand regard	Delayed rec. regard
Cup			Immed. prolong. regard Hand regard Contacts cup	Shifts reg. hand to cup Arms activate
Bell				Prompt prol. regard Arms activate

§ 2. GROWTH TREND CHART. SECOND QUARTER: 16-28 WEEKS

	16 Weeks	20 Weeks	24 Weeks	28 Weeks
Chair	Slumps Erects head, nodding Regards TT, hands Fingers TT Regards Ex.	Head steady Regards toy on table Scratch TT	Trunk erect Grasps toy on TT	Dangles or bangs toy on TT
Cubes: First	Follows Ex. withdraw'g hand Regards cube recurrently Arms activate Contacts cube Reg. shifts cube to hand		Delayed 1 hand appr. & grasp Palmar grasp Cube to mouth Drops cube	Immed. 1 hand appr. & grasp Radial palmar grasp Retains cube
Second		Retains 1st as 2nd presented Regards 2nd		

(see next page)

GROWTH TREND CHART. SECOND QUARTER: 16-28 WEEKS (Continued)

	16 Weeks	20 Weeks	24 Weeks	28 Weeks
Second Cube (Continued)		Drops 1st......... Approach, contact 2nd....		
Third		Drops 1 immed......... Regards dropt cube......... Drops other cube......... Delayed regard 3rd.........	Resecures dropt cube......... Immediate regard 3rd. Delayed appr., contact 3rd	Holds 2 cubes more than mom. Immed. appr. contact 3rd.... Transfers cube.........
Massed Cubes		Visual pursuit screen......... Approach......... Grasps 1, tactile cue......... Precarious grasp.........] Drops immed......... In all, grasps 1 cube.........	Reaches for screen......... Scatters cubes......... Delayed grasp 1, visual cue ... Holding 1, appr. another...... Drops......... In all, 2 cubes.........	Immed. grasp 1, visual cue Mouths cube......... Holding 1, grasps another ..... In all, 3 cubes.........
Pellet Follow Ex. withdraw'g hand .... Delayed, recurrent regard...... Hand regard.........			Delayed intent regard ...... Whole hand approach..	Contacts......... Rakes.........
Cup Immed. regard......... Arms activate.........		Immed. approach......		

Contacts	Contacts........	Hands on sides........	
Regard shifts cup to hand......]		Grasps handle........	
		Lifts cup........	Lifts & uprights cup........
		Cup to mouth........	
		Drops........	
Bell			
Prompt regard........		Immed. 2 hand appr., grasp ..	Immed. 1 hand appr. & grasp.
Arms activate........	2 hand appr., contact....	Bell to mouth........	
		Free hand engages........	Adept transfer........
		Two-stage transfer........	Bangs........
			Retains........
		Drops........	
Supine			
Head midline predom........			Lifts head from platf........
T-n-r positions seen.........]			
Sym. positions predom........			
Hands engage........			
Hands open or loosely cl.....	Hands open........		
Finger, scratch, clutch........			
Legs flex & ext. sl. lifted....]		Legs lifted high in ext........	(Situation curtailed)
Smiles at Ex. spontan........	Regards Ex........	Rolls to prone........	
	Rolls to side........		
D. Ring			
Prompt midl. regard........			
Arms activate........	Approach, contact........	Immed. appr. & grasp........	
Placed in hand........	Grasps near hand only .....]		
Regards ring in hand........			
Mouths ring........			
Free hand approaches........		Holds with 2 hands........	Transfers........
Retains........			

GROWTH TREND CHART. SECOND QUARTER: 16-28 WEEKS (Continued)

	16 WEEKS	20 WEEKS	24 WEEKS	28 WEEKS
Rattle				
	Prompt midl. regard	2 hand appr., contact	Immed. appr. & grasp	Immed. 1 hand appr., grasp
	Arms activate	Grasps near hand only]		
	Placed with ease			
	Regards Ra in hand			
		Mouths Ra	Free hand fingers	Shakes activ. & vigor'sly
		Free hand approaches	Retains	
	Drops	Visual purs. lost Ra	Prehensory purs. lost Ra	
Bell Ring				
	Attends, activity reduced]		Turns head to bell	
	Facial response			
Pull Sit				
	Slight head lag	No head lag]	Lifts head, assists pull	
	Vocalizes or smiles, attains sitting			
Sit				
	Head set forward, steady	Head erect, steady	Sits v. mom., leaning forward	Sits mom.+, lean forw. prop. on hands
	Lumbar curvature		Brief passive balance	Sits erect v. moment
				V. brief active balance
				Active in sitting
Stand				
	Small frac. wt. briefly			Large frac. wt.
	Legs extend recurrently			
	Curls toes]			Bounces

Rises to toes...

Lifts foot..

Prone

Head compensates...

Holds head in Zone III, sust.............................

Arms flexed, on forearms.................................

1 arm flexed, 1 extended.................................

Verge of rolling...

Legs extended or semi-ext................................

Arms extended, on hands..................................

Scratch platform...

Legs extended..

Lifts arm to lure..

Attempts pivot, unsuccess................................

Mirror

Regards own image..

Smiles...

Vocalizes..

Pats mirror..

Language (include report)

Ah-uh-eh...

Smiles...

Coos...

Laughs...

Breathes heavily, strains, excites.......................

Squeals..

Grunts, growls...

Polysyllabic vowel sounds................................

M-m-m sound (crying).....................................

Personal-Social Interview

Dress over face..

Hand play, mutual fingering..............................

Sits propped 10-15 min...................................

Anticipates on sight food................................

Pats bottle..

Discriminates stranger...................................

Grasps feet..

Sits propped 30+ min.....................................

Feet to mouth..

Spontan. vocal-social....................................

Takes solids well..

§ 3. GROWTH TREND CHART.　THIRD QUARTER: 28–40 WEEKS

	28 Weeks	32 Weeks	36 Weeks	40 Weeks
Chair				
	Head steady			
	Trunk erect		Sits on platform, good control	
	Grasps toy on TT		Holding 1, grasps 2nd	
	Dangles or bangs toy	Transfers toy		
Cubes: First				
	Immed. appr. & grasp			
	Radial palmar grasp		Radial digital grasp	
	Cube to mouth			
	Retains cube		Transfers cube	
Second				
	Retains 1st during presenta	Retains 1st throughout		
	Regards 2nd			
	Appr., contact 2nd	Appr., grasps 2nd		
		Mouths cube		
		Holds 2 cubes briefly		
	Drops cube		Drops and resecures	
				Holds 2 cubes prolongedly
				Retains both cubes
Third				
	Drops 1 immed	Retains both on presenta		
	Immed. regard 3rd			
	Immed. appr., contact 3rd	Appr. 3rd with cube in hand	Grasps cube 3rd	
			Hits or pushes with cube in hand	
	Drops cube			
	Resecures dropt cube			
	Transfers cube			
	Holds 2 cu. more than moment	Holds 2 cubes prolongedly		Matches 2 cubes

Situation			
Massed Cubes			
Reaches screen.			
Follows screen.			
2 hand appr.			1 hand appr.
Immed. grasp 1 cube.		Immed. grasp 2 cubes.	Immed. grasp 1 cube.
			Selects top or corner cube.
			Controlled play.
Scatters cubes.			
Holding 1, grasps another.			
Mouths cube.			
Grasps 3 or more in all.			
Drops cube.		Drops and resecures.	Crude release.
Cup & Cubes	Approaches cubes first.	Approaches cup first.	
	Takes cup by rim.		
	Drops cup.		
	Takes cube.	Brings cube against cup.	
	Holds cube, regards cup.	Drops 1 for other.	
	Drops cube.	No alt. behav., command, gest.	
		No alt. behav. demonstra.	Reaches into cup, fingers cube
Pellet			
Follows Ex. withdr. hand.	Immed. regard and approach.		
Delayed intent regard.			Index finger approach.
Appr. & contact.	Radial raking.		
Whole hand raking.	Unsuccess. scissors attempt.	Prehends, scissors grasp.	Prehends promptly, inf. pincer.
Pellet in bottle		Eyes drop.	
		Takes bottle.	
		To mouth.	
		Quest. regard pellet in bo.	
		(P. falls out) disregards P.	Regards pellet (fallen).

GROWTH TREND CHART. THIRD QUARTER: 28-40 WEEKS (Continued)

	28 Weeks	32 Weeks	36 Weeks	40 Weeks
Pellet beside bottle				
			Reaches bottle first	Reaches pellet first
			Disregards pellet	Takes pellet, drops
			Takes bottle	
Bell				
Immed. 1 hand app. & grasp				
Grasps bowl or junction				
To mouth				By handle
Transfers adeptly				
Bangs				Shakes or waves
Retains				
Ring-string				
Regard ring first				
Reach toward ring				
Slap, scratch TT				
Regard string				
Contact string		Rakes at string		
		Pulls or drags in		Plucks string easily
		Secures ring	Prehends string, pulls in	
		Transfers ring		
			Manipulates string	
Fuss or abandon effort		Persistent, difficulty		
Sitting				
Sits very momentarily		1 min. or more	10 min.+ (thru exam.)	Indefinitely
Sits leaning fwd. onto hands				
Erect momentarily		Erect		
Almost active balance		Active balance		
Unsteady			Steady	
Active in sitting			Leans fwd. and re-erects	
Falls				Sitting to prone

Standing
Support by trunk..........
Large fraction weight..........
Support by hands..........
Full weight briefly..........
Legs ext. recurrently..........
Legs ext., hips sl. flexed..........
Bounces..........]
Full weight, sustained..........
Stands holding rail..........
Legs extended..........
Pulls to feet at rail..........
Lowers self from rail..........

Prone
On abd. & ext. arms..........
Lifts arm..........
Unsuccess. attempt pivot..........
Pivots..........
On hands & knees..........
Creeping position (boys)..........
Collapses to prone (boys)..........]
Creeps..........

Mirror
Reg. own image..........
Smiles..........
Vocalizes..........
Pats mirror..........
Leans forward..........]

Language
Smiles..........
Laughs..........
Squeals..........
Grunt..........
M-m-m crying..........
Polysyll. vowel sounds..........
Da, ka, ba, ga, etc...........
Breathes heavily, strains, excites..........]
Dada..........
Imitates sounds..........
Understands name, no-no..........
Mama..........
And bye & patacake..........
One "word"..........

Personal-Social
Discrim. strangers..........
Feet to mouth..........]
(see next page)

GROWTH TREND CHART. *THIRD QUARTER: 28–40 WEEKS (Continued)*

	28 WEEKS	32 WEEKS	36 WEEKS	40 WEEKS
Personal-Social (Continued)				
Sits propped 30 min.+				
Pats bottle			Holds bottle	
Takes solids well			Feeds self cracker	
Bites, chews toys				
Reach persist. toy out of reach				
Sits indef. unsupported				
Pat-a-cakes				
Waves bye				

§ 4, GROWTH TREND CHART. *FOURTH QUARTER: 40–52 WEEKS*

	40 WEEKS	44 WEEKS	48 WEEKS	52 WEEKS
Sits on platform, good control				
Holding 1 toy, grasps 2nd				
Transfers toy		Dangles or bangs toy		
Cubes: First				
Immed. appr. & grasp				
Radial digital grasp				
Transfers cube				
Retains cube				
Second				
Retains 1st throughout				
Appr. & grasp 2nd				
Mouths cube				
Retains both cubes				

Third			
Retains 2 on presentation....	Retains 2 throughout....	Retains 2 on presentation....	....
Hits, pushes cube with cube....	....	....	....
Match 2 cubes....	....	....	....
Drops cube.....]	....	Drops cube....	....
Tower			
		Cube to model....	Takes cube from model....
			Cube on cube without release..
			Attempts tower, it falls....
Massed Cubes			
Reaches for screen....	....	....	....
1 hand approach....	....	2 hand approach....	....
Takes 1 cube first appr....	....	Takes 2 cubes....	....
Selects top or corner cube....	....	....	....
Holding 1, grasps another....	....	....	....
Controlled play....	....	Sequential play, 1 by 1....	....
Releases cube....	....	....	....
Grasps 3 or more in all....	....	....	4 or more in all....
Cup & Cubes			
Grasps cup first, by rim....	....	....	....
Takes cube....	....	Removes cube from cup....	....
Fingers cube in cup....	Removes cube from cup....	....	....
Cube against cup....	Cube into cup without release.	....	Release 1 cube into cup....
Pellet			
Index finger approach....	....	Thumb and index approach....	....
Prehends promptly....	....	Neat pincer grasp....	....
Inferior pincer grasp....	....	....	....
Pellet in bottle			
Eyes drop....	....	....	....

GROWTH TREND CHART. FOURTH QUARTER: 40-52 WEEKS (Continued)

	40 Weeks	44 Weeks	48 Weeks	52 Weeks
Pellet in bottle (Continued)				
	Questionable regard P in Bo	Definite regard P in Bo		
		Points at P through glass		
	Takes bottle			
	Bottle to mouth]			
	Regards P if drops out	Grasps P if drops out		
Pellet beside bottle				
	Reaches pellet first			
	Takes pellet	Retains pellet. [	Takes pellet only	Pellet over bottle
	Drops pellet		To mouth	Tries insert, unsuccessful
	Takes bottle]			
Bell				
	Grasps by handle	Grasp by top of handle		
	To mouth			
	Transfers			
	Shakes or waves	Regards & pokes clapper		
Ring and String				
	Approach ring first	Approach string first		
	Plucks string easily			
	Secures ring			
	Transfers ring			
	Manipulates string			Dangles ring by string
Formboard				
	Pulls at formboard			
	Accepts round block			

Transfers round block............
Releases round block............
(Examiner inserts)
Removes with difficulty....
Transfers round block..
Releases round block............

Ball
Accepts ....
Mouths ball......
Releases ball......

Mirror & Ball
Regards own image............
Leans forward............
Pats mirror............
Smiles, vocalizes............
Accepts ball............
Reach mirror for image ball....
Retains ball......
Release ball......

Posture & locomotion
Sits indefinitely............
Goes from sitting to prone....
Creeps............
Pulls to feet at rail............
Lifts foot, full wt, at rail......
Lowers self from rail......
Full wt., hands held............

Language
Dada............
Mama.......

Looks selectively round hole...
Looks selectively round hole...
Bang or release near round hole
Removes easily............
Extends to Ex, no release......
Casts ball............
Ball to mirror......
Retains ball......
Pivots in sitting............
Cruises at rail............
Lifts foot, full wt, at rail......
Walks 2 hands held............
Walks 1 hand held......

GROWTH TREND CHART. *FOURTH QUARTER: 40–52 WEEKS (Continued)*

	40 WEEKS	44 WEEKS	48 WEEKS	52 WEEKS
Language (Continued)				
1 word..........				2 words....
Imitate sounds..........				
Comp. no, name, bye & patacake..........				And also "give"....
Personal-Social				
Holds own bottle..........		Drinks some milk from cup....		
Feeds self cracker..........				Co-operates dressing..........
Patacakes & waves bye.				Gives to Ex. or mother....
		Extends toy to Ex. or mother, no release..........	Toy to side rail.......... Platform play..........	

The GROWTH TREND CHART for the period of LATER INFANCY is continued in less detail on the next two pages (pp. 446-447), and includes the following age levels:

15 months
18 months
21 months
24 months
30 months
36 months

	15 Months	18 Months	21 Months	24 Months	30 Months	36 Months
Book	Helps turn pages · · · · · Pats pictures · · · · ·	Turns 2-3 pages · · · · · Looks selectively · · · · ·	· ·	Turns pages singly · · · · · Names pictures · ·	· · · · · · · · · · · · · · · ·	Gives action · · · · ·
Cubes	Tower of 2 · · · · · ·	Tower of 3-4 · · · · ·	Tower of 5-6 · · · · · · · · · Train—pushes cube · · · · · ·	Tower of 6-7 · · · · · · · Aligns 2 cubes · · · · ·	Tower of 8 · · · · · · · · · Adds chimney · · ·	Tower of 9-10 · · · · · · Imitates bridge · · · ·
Cup & cubes	6 cubes, in and out · · · · · ·	10 cubes in · · · · ·	· · · · · · · · · · · · ·	Hands full cup to Ex. · ·		
Pellet & bottle	Inserts, no demonstration ·	Dumps pellet · ·				
Drawing	*Holds crayon in fist* · *Imitates scribble* · · · · *Incipient imitation stroke* ·	Spontaneous scribble · Imitates stroke · · · · ·	· · · · · · · · · · · · · · · ·	Imitates vertical stroke. Imitates circular stroke	Holds crayon in fingers · And horizontal stroke · Strokes twice for cross · ·	Names own drawing · Copies circle · · · · · Imitates cross · · ·
Color forms				Places one · · · · · ·		Places 3 · · · · ·
Formboard	(Round block only given at 15 mos.) Places round block · · · · · Adapts round block · · Casts round block · · · ·	(3 blocks given) Piles 3 in tower formation Inserts one · · · · · · · No adaptation · · · · · ·	Inserts two ·	Places separately on board. Inserts all Adapts after 4 trials · ·	Inserts all on presentation. · · Adapts repeatedly, persist, error · ·	· · · · · · · · · · · · · · · Adapts, no error or immed. correct
Picture card		Names or points 1 picture · · · ·	· · · · · · · · · · · · ·	Names 3, points 5	Names 5, points 7 ·	Names 8 · · · · ·
Digits					Repeats 2 digits · ·	Repeats 3 digits · · · · · ·
Name, Sex					Full name.	And sex · · · · ·
Performance box		Square block flat against box. · · ·	Inserts corner of block · · ·	Inserts square block. · ·		
Test objects		Names ball · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · ·	Names two · · · · ·	Gives use · · · · · · · · ·	
Comprehen. Question						Answers one · · · · · · · · · · · · ·
Ball	Casts · · · · ·	Hurls · · · · · · · · · · · · · · Walks into · · · · ·	Kicks (demonstration) · · · · · ·	Kicks (command) ·	· · · · · ·	· · · · · · · · · · · · · · · · ·
Directions		2 directions with ball · · ·	3 directions · · · · · · · · ·	4 directions · · · · ·	· · ·	2 prepositions, ball & chair · · · · · · · ·
Ball in box		Reaches · · · · · · · · · · · · Abandons · · · · ·	Gets ball · · · · · · · ·	· ·		
Stand—1 foot					Tries to stand on 1 foot · · ·	Stands on 1 foot, mom. balance · · · · ·
Walking, Running, etc.	Alone several steps · · · · · · · · Falls by collapse · · · · · · · ·	Well, seldom falls · · · · · Walks fast, runs stiffly · ·	Squats in play · · · · · · · · · · ·	Runs fairly well · · · · · · ·	On tiptoe · · · · · Jumps on both feet · · · · ·	Rides tricycle · · · · ·
Stairs	Creeps up flight · · · · · · · · ·	Walks up, 1 hand held · · · · · · · ·	Up, holding rail · · · · · · Down, 1 hand held · · · · ·	Up alone · · · · · · Down alone · · · · · · ·		Up, alternates feet · · · · · Jumps from last step · · · · ·
Chair		Seats self in small chair · · · · · · Into adult chair · · · · · · · ·				
Vocabulary & Speech	Jargon · · · · · 4-6 words · · · ·	10 words · · · · · · ·	20 words or more · · · · · Joins 2 words · · · · · · · · ·	3 word sentence or better · · · Pronouns · · · · · · · · ·		Plurals · · · · ·
Feeding	No bottle · · · Inhibits grasp dish · · · · ·	Feeds self in part, spilling · · · · · · Hands empty dish to mother · · · · ·	Handles cup well · · · · · · · · ·	Inhibits turning spoon · · · · ·	· · · · ·	Pours from pitcher · · · · · · · Feeds self well, no spilling · · ·
Toilet	Bowel control · · · · · · Partial toilet regulation · · Indicates wet pants · · · · ·	Daytime regulation · · · · ·	· · · · · · · · · · · · ·	Dry nights, taken up · · · Verbalizes needs consistently · · · ·		Assuming responsibility · · · · · ·
Dress	*Co-operates in dressing* · · · · · · · · ·			Pulls on simple garment · · · · ·		Shoes on, unbuttons acces. buttons · ·
Communication	Indicates wants, points & vocalizes · · · · Shows or offers toy · · · · ·		Pulls person to show · · · · · · · Echoes 2-3 last words · · · Asks for food, toilet, drink · · ·	Asks for "another" · · · · · Soliloquizes on experiences · · · Refers to self by name · · · ·	Speech repetitious · · · · · Self by pronoun · · · · ·	Knows a few rhymes · · · · Understands taking turns · · · · ·
Play	Casts toy · · · · · · · · · ·	Pulls toy · · · · · Carries, hugs doll · · · · ·	· · · · · · · · · · · · · · ·	Plays with domestic mimicry · · · · · Parallel play with other children · · ·	Pushes, good steering · · · · · · Helps put things away · · · · · · Carry breakable object · · · · ·	· · · · · · · · · · · · · · ·

APPENDIX C

EXAMINATION EQUIPMENT

§ 1. ARRANGEMENTS FOR HOSPITALS AND INSTITUTIONS

The basic procedures of developmental diagnosis are so simple that arrangements for examination can be set up with very slight equipment. In Chapter II we have shown how the ordinary furniture of a physician's office and a portable test table can be made to serve the needs of a formal behavior examination. Once the examiner is well versed in the principles and methods of diagnosis, simple expedients can be successfully used in the home and on the children's ward for partial and indicative observations.

In hospitals and child care institutions, there is no need to depend on improvised and makeshift arrangements. If developmental examinations are made routinely and systematically it is advisable to set aside a separate room or a suite of rooms especially equipped for the purpose. The necessary apparatus is comparatively inexpensive. Much is gained by conducting the examination under standardized conditions in simplified surroundings which insure a minimum of distraction for the child. The furnishings of the room should be limited to essentials. Murals, pictures, and special toys are not advised. The examination affords ample attraction.

Figure 15 pictures a compact three-room arrangement. All the features of this arrangement, even including a one-way-vision window can be combined in a single room if necessary. The diagram is drawn to show the differences in examination equipment for infants and for children of preschool age. A functional description of the arrangements follows.

(a) First, we shall assume a child of preschool age, accompanied by nurse or mother. The child enters at (1), passes through the hall-

way (2) which connects with the reception room (3) (and also with the bathroom at 6). The reception room is furnished with adult chairs and a play pen (4) and child's chair (5). The observation
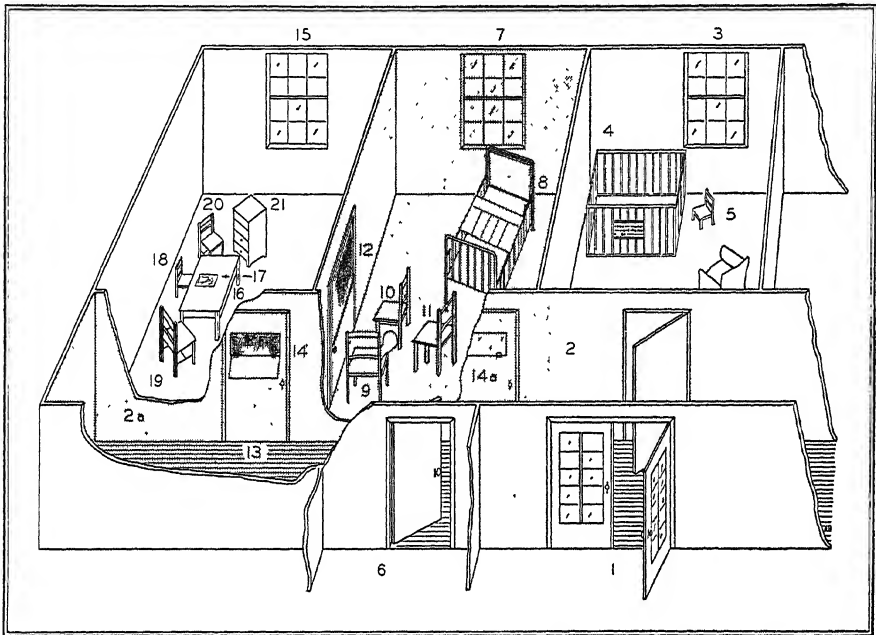
FIG. 15. Arrangements for a developmental examination suite.

room (7) has been partially darkened by drawing the shade at the window. The recorder takes station in the chair equipped with writing arm (9). Observers can be seated nearby, behind the one-way-vision screen window (12) which communicates with the examination room (15), entered by the door (13), also equipped with one-way-vision window (14). The examination room is equipped with an examination table (16) showing the picture book (17) and child's chair (18) in position. The mother sits at the right (19); the examiner at the left (20), with direct access to the examining cabinet (21).

(b) If the child is of infant age, the same facilities are used in a slightly different manner. Room 7 becomes the examining room and room 15 the observer's and recorder's room. The one-way-vision screen window in the communicating door (12) operates equally

well in the reverse direction. The examining crib is moved to a favorable position. If the child is 16 weeks of age or over he is usually placed at once in the supporting examining chair, confronting
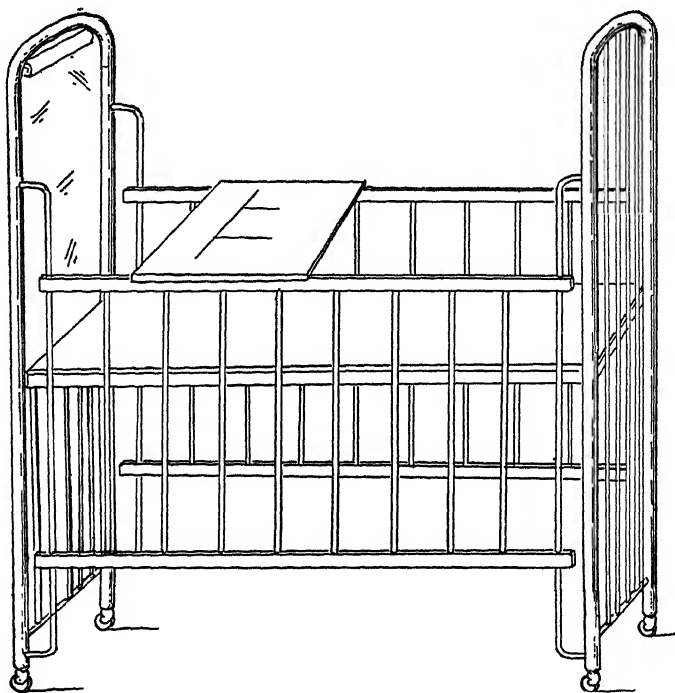
FIG. 16. Clinical crib, showing platform, table top (on adjustable sidepanels) and roller shade covering mirror.

the table top on which the test objects are placed. The one-way-vision facilities will be described in greater detail in the next section (§ 2).

Crib and chair are pictured in Figures 16 and 17. The crib is an ordinary hospital crib with adjustable side panels, which has been fitted with a sturdy wooden platform in place of springs, at a height of 30 inches from the floor. A blotter, absorbent pad, or blanket covers this platform on which the infant is placed for observations of supine, prone, and postural behavior. One of the side panels is elevated to full height to elicit standing and cruising behavior.

The panels are adjusted to a suitable height for the table top. If

the infant cannot sit securely alone, he is placed in the supportive chair. If he needs no support he sits on the platform. For the table top situations, the examiner stands at the corner of the crib, some-
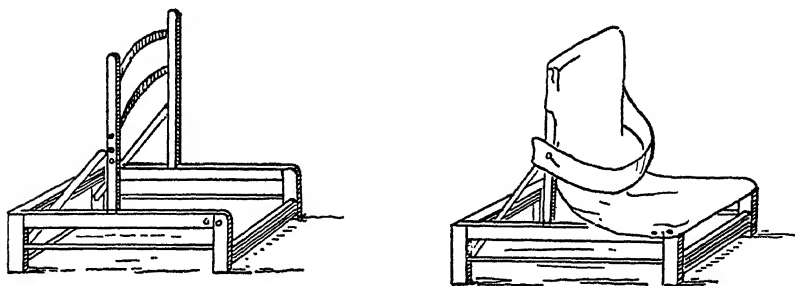
FIG. 17. Clinical infant chair.

what out of the infant's range of vision. This position brings the test materials within easy reach. They are removed one by one from the pockets of a shoe-bag type of container which is hung over the head-end of the crib.

The construction of the supportive infant chair is indicated in Figure 17. The chair is provided with a washable and removable canvas covering. The infant is secured in position by a broad canvas band.

The clinical high chair, delineated in Figure 18, is especially well adapted for children of larger size with motor disabilities or for children about 15 months of age who are too active for the crib. It will be noted that this clinical high chair arrangement consists of two separable parts. The table unit locks into the chair unit to make a solid single unit which keeps the infant securely and comfortably in an optimal position. The table unit can be readily detached and is very serviceable in those exceptional cases where the infant must be held in the mother's lap to be examined to best advantage. Being of adjustable height the table can be brought up to the infant seated in the lap.

A portable test table suitable for use on a children's hospital ward or in a physician's office is pictured in Figure 19; an observation play pen in Figure 20.
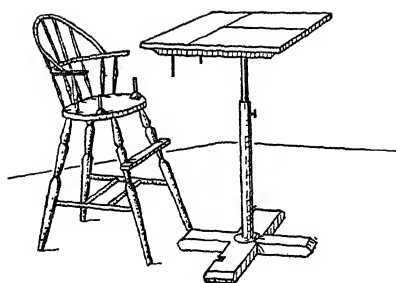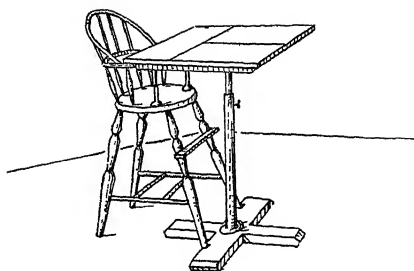
FIG. 18. Clinical high chair.
A. With detachable table.
B. Locked in a single unit.
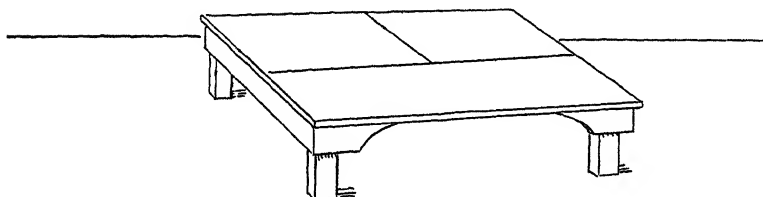
FIG. 19. Portable test table.
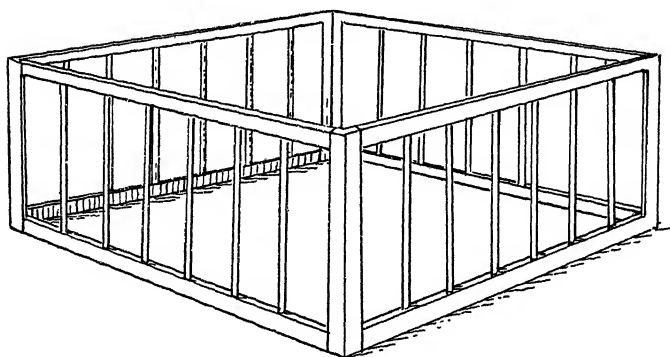
FIG. 20. Observation play pen.

§ 2. ONE-WAY-VISION FACILITIES

The one-way-vision screen is so named because it is transparent in one direction only. The screen is placed between an observation alcove and the examining room. The surface of the screen facing the examining room is painted white to produce a diffuse dazzle which makes the screen appear opaque. If the examining room is well lighted and the observation alcove darkened, the opaque effect from the examining room side is enhanced. At the same time the transparency of the screen to observers in the alcove is in no way interfered with. An arrangement of this sort may accommodate a whole group of persons who can watch an examination without disturbing the rapport between examiner and child,—without being seen.

The device is extremely simple and adaptable. If two adjoining rooms are to be used, a window can be cut into the connecting door and a screen installed in the window. If only a single room is available, an observation alcove can be made by erecting a thin partition from floor to ceiling across the end of the room and incorporating a screen into the partition. Such simple one-way-vision windows are so simple and economical that they can be readily incorporated in a doctor's office, as well as in the more elaborate equipment of a hospital or child caring institution. A one-way-vision window incorporated in an ordinary connecting door is pictured in Figure 21. An opening was cut out of the door and an ordinary 16-mesh-wire screen was inserted. (The door can be made opaque by drawing down a roller shade.) For directions for processing the screen see § 3.

The uses and the architectural disposition of the one-way-vision screens have already been indicated in Figure 15. For example, Room 7 when darkened becomes an observation room; which permits one-way-vision through the screen in connecting door (12). The (invisible) observer sits within a few feet of the child and the examiner, intimately witnessing the slightest movements and able to hear the vocalizations and conversation. The oblong panel (14) also gives upon the examining room, and being at eye-level, it permits either prolonged or casual observation from the darkened hallway. The small panel has proved convenient in the course of clinical work because it offers more or less brief glimpses of an examination with a minimum of disturbance and pre-arrangement. The larger observa-

tion window (12) in the pictured location is doubly convenient because it can be made to serve in either direction. The observation room can be converted into an examining room and vice versa.
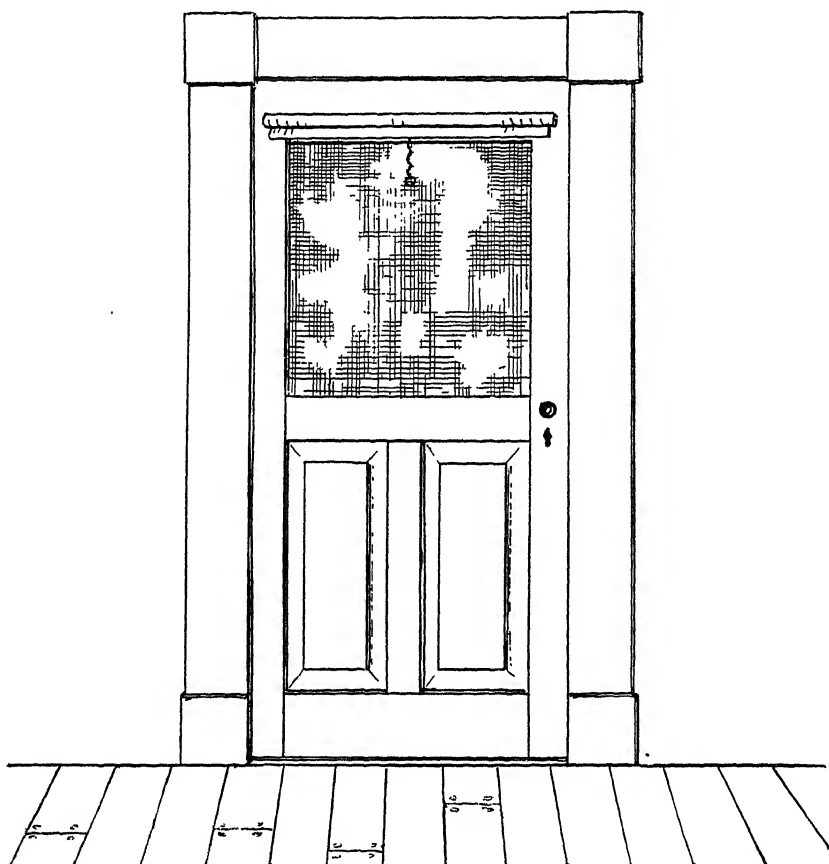
Fig. 21. One-way-vision window installed in an ordinary door.

Hospitals have installed one-way-vision facilities to aid in the demonstration of patients. The advantages of psychiatric demonstrations, as well as for observation, are obvious.* Not only does the screen create conditions otherwise unobtainable, but it tends to accentuate visual impressions. The simplicity and the flexibil-

* Further uses and adaptations of one-way-vision arrangements are described in Gesell et al., *The First Five Years of Life. A Guide to the Study to the Preschool Child.* New York: Harper & Bros., 1940. Pp. xiii + 393. (See p. 353.)

ity of the one-way screen and its permeability to air, sound, and light give it peculiar advantages. Fortunately these advantages can be realized with relatively slight expenditure of funds and of ingenuity.

§ 3. The Preparation of a One-way-vision Screen

Ordinary 16-mesh-wire screen can be used. Thin white enamel paint may be applied with painter's brush in the regular manner, if done with care so as not to clog the mesh. The paint should dry between the several coats. No. 30 wire cloth has definite advantage, particularly if casein paint instead of ordinary enamel is used. The casein paint should be thinned down with water to the consistency of thin cream and then applied with an air brush. At intervals the air brush should be used to force air only through the screen in order to blow out any excess paint which may have clogged the mesh. This process is repeated four or five times. Casein paint dries rapidly and the successive coats may be applied in the course of one day.

It is best to apply the paint before the screens are permanently mounted. If the screens are already in position, an absorbent barrier should be placed behind the screen to collect the transmitted paint spray.

The location of the observers' station is of critical importance. The station should be as dark as possible. Enough light for ordinary recording purposes will in any event enter through the screen. Ideally the observation station should be located on the window side of the room. Care should be taken so that direct light from windows or from lamps will not strike directly through the screens. Such direct rays of light tend to reveal the observer's eye glasses and light colored objects. Invisibility is increased by wearing dark clothes. The efficiency of the one-way-vision screen is also increased if the room upon which the screen gives is illuminated by indirect rather than direct lighting.

The walls of the observation station should be painted black or midnight blue. Dark curtains draped on the walls and thick carpeting on the floor serve to silence sounds inadvertently made by the observers. Placement of plate glass behind the screen excludes sound but interferes with ventilation. Strict silence is an extremely important rule. Our injunction to the observer who enters the station for the first time is, "Be absolutely quiet. The child can hear you even though he cannot see you."

APPENDIX D

CINEMATIC CASE STUDIES

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§ 1. CINEMA RECORDS OF CHILD DEVELOPMENT

The Yale Clinic of Child Development has used the cinema as a systematic research tool for recording and analyzing the development of patterning of behavior in infancy and early childhood. The cinema records embrace the first year of life with follow-up studies of the later ages. The records were made under standardized conditions and are comparable from age to age. They document both normal and abnormal behavior development. The films have been collected into a photographic research library and have been indexed in detail to facilitate investigation.

These extensive cinema records form the basis of films which have been edited in both sound and silent versions. Through a cooperative arrangement with Yale University, these films are distributed by Encyclopaedia Britannica Films Inc., 20 North Wacker Drive, Chicago 6, Illinois, and are procurable on either rental or purchase basis. The sound films carry a spoken commentary (by Gesell) and are designed to give a systematic view of the course of normal child development.

Sound Series. The subject matter of these individual sound films (each 400 feet in length in 16 mm. size) is indicated by the following titles.

(1) *The Growth of Infant Behavior: Early Stages*
Behavior of infant at 8, 12, 16, and 20 weeks of age. Animated diagrams to illustrate the concept of behavior patterns.

(2) *The Growth of Infant Behavior: Later Stages*
Animated diagrams depicting the growth of the fetal hand. The patterning of cube behavior at 24, 28, 40, and 52 weeks, portrayed by coincident projection of adjacent ages.

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(3) *Posture and Locomotion*
   Typical postural behavior at 13 successive age levels.
(4) *From Creeping to Walking*
   Creeping, cruising, pivoting, assisted and independent walking.
(5) *A Baby's Day at 12 Weeks*
   Record of a total behavior day, showing child care situations: sleep, bath, feeding, sunning, etc.
(6) *A Thirty-Six Weeks Behavior Day*
   A similar record of the same infant six months later, showing progress in performance and social maturity.
(7) *A Behavior Day at 48 Weeks*
   The cycle of a representative domestic day. Psychological aspects of child care in the home.
(8) *Behavior at One Year*
   Characteristic behavior patterns as demonstrated by reactions to developmental test situations.
(9) *Learning and Growth*
   Comparative delineations of the same child at different ages to show the dependence of learning ability on maturity factors.
(10) *Early Social Behavior*
   Ten children from 8 weeks to 7 years of age are depicted in a variety of social situations to reveal individual and maturity differences.

The foregoing films are relatively nontechnical in character, and were designed for group instruction rather than individual study. They outline the course of normal development in sufficient detail to serve as a background for the more technical use of cinema records to be described later.

Silent Series. The subject matter of the individual silent films, also each 400 feet in length, 16 mm. size, is indicated by the following titles.

(1) *How Behavior Grows: The Patterning of Prone Progression*
   This film traces stage by stage the manner in which a baby acquires the power to creep and to rise from a horizontal to an upright position.
(2) *The Growth of Motor Behavior in the First Five Years of Life*
   Depicts advancing stages of motor control of eyes, hands, trunk, legs throughout the first five years.
(3) *The Growth of Adaptive Behavior in the First Five Years of Life*
   Deals chiefly with the finer motor coordinations and discrimina-

tions which the mind makes in its conquest of the world of things. This world is here typified by test cubes, pellet, and paper and pencil.

(4) *Infants are Individuals: The Beginnings of Personality*
Motor, adaptive and personal-social behaviors of several children are depicted in such a way as to show that each individual has a distinctive behavior makeup which manifests itself in infancy as well as in later life.

(5) *Twins are Individuals: Twins T and C from Infancy to Adolescence*
Cross sections of the behavior of these twins from infancy through adolescence disclose not only striking similarities but also consistent differences which continue into the teens.

(6) *The Baby's Bath*
Depicts the baby's bath at varying ages in home-like surroundings. Calls attention to the behavior aspects of the bath experiences.

(7) *Bottle and Cup Feeding*
Delineates guidance suggestions. The progressive motor coordinations displayed in the bottle and cup feeding situations at advancing age levels.

(8) *The Conquest of the Spoon*
A similar developmental portrayal of the mastery of the spoon as a complicated cultural tool.

(9) *Self-Discovery in a Mirror*
The baby's reactions to his mirror image reflect the advancing stages in the organization of his social behavior.

(10) *Early Play*
Portrays both spontaneous and induced play activities at advancing stages of maturity.

THE MARCH OF TIME recently made a documentary film recording the work of the Yale Clinic of Child Development. The film is sound scored and is now available in 16 mm. size in the Forum Edition of The March of Time, 369 Lexington Avenue, New York 17, New York, on a rental or purchase basis (showing time 18 minutes).

§ 2. CLINICAL CINEMATOGRAPHY

The cinema is particularly useful for documenting neurological syndromes; and for demonstrating abnormalities of posture, gait and movement. Fifty feet of film will depict and summarize the clinical characteristics of a patient with a detail and comprehensiveness

which no descriptive report could hope to rival. Inasmuch as the original record was made at a known photographic speed (e.g., 16 exposures per second) the time values of the different movements are inherent in the film and can be quantitatively studied if so desired. If the case is kept under periodic supervision, cinema records can be made from time to time and can be subjected to comparison to note changes, improvement, or deterioration.

For example, a run of only 10 seconds gives an excellent picture of how a 28-weeks-old infant approaches and grasps an object. Thirty seconds of film will delineate a whole episode of manipulation and exploitation of this object. A similar record at the age of 32 weeks, 40 weeks, or a year will show whether and how his exploitive behavior and attentional adjustments have progressed in the intervening time.

The cinema has now become a sufficiently economical medium to justify a more routine use as a case recorder and as a diagnostic tool. This is particularly true of hospitals and child caring institutions which are in a position to work out standardized procedures and to maintain research activities. For numerous problems in the field of developmental diagnosis and supervision, clinical cinematography has a function analogous to that of X-ray photography. It is an ideal instrument for the visualization and analysis of behavior characteristics.

§ 3. CINEMANALYSIS: A METHOD OF BEHAVIOR STUDY

Cinemanalysis is a method of observation which permits us to examine the successive phases of motion with complete deliberation. The simplest device for accomplishing this analysis is an ordinary projector, mounted on a portable vertical stand which rests on a desk or table, as pictured in the accompanying illustration. The projector is operated by a small handcrank and throws an image 4 by 5 inches in size upon a white enamel plate. The operator controls the successive images by means of the crank. He employs the analytic viewer in much the same way that he would use a microscope for histologic study. In one case he examines a specimen of tissue; in the other, a specimen of behavior.

Cinemanalysis, therefore, is extremely simple in principle. It is nothing more or less than an objective method for observing the

forms of behavior patterns by alternately stilling and animating the cinematic images. The numerous illustrations of typical behavior patterns which appear in Chapter III are reproductions of tracings of images which fell upon the white enamel plate of the analytic viewer. Similarly the pictorial delineations of *An Atlas of Infant Behavior* depict selected pattern phases of the reactions of the infant in normative and naturalistic situations. An analytic viewer enables the student to explore these patterns in their full context of motion.

The construction of the analytic viewer* is pictured in Figure 22. The viewer consists essentially of a 16 mm. projector (D) mounted on a portable stand (E). The whole apparatus weighs approximately 16 pounds and can be readily carried by the handle (F). It may be conveniently placed on a work table or desk, the electric current being supplied through the extension cord (H), with a switch at (I). The projector may be driven by an electric motor, but ordinarily it is operated by the hand crank (G). The film (C) passes through the projector from a supply reel (A) to a takeup reel (B), each frame being registered by a frame counter (L). The projector, equipped with a 1-inch lens, throws an image on the tracing plate (K); the strength of the illumination is controlled by a rheostat (J).

§ 4. SELF INSTRUCTION FILMS

Educational films are generally designed for congregate showings. They are organized for classroom and auditorium rather than for the laboratory. For practical clinical applications and for the training of medical students we need materials and methods which are adapted to individual laboratory study. Ordinary projection is too rapid and fleeting to permit real study. The observer should have the images of motion under his direct control. He needs an individual projector which he himself operates. This is the method of cinemanalysis.

Assume a film which has recorded the prehension and release of a pellet. The image of the behavior falls on the plate at reading dis-

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* The analytic viewer is not available on the market, but may be readily built from standard parts by a technician. The total cost of these parts amounts to $50-$65: projector, $30-$45; rheostat, $5; counter, $8.50; pulleys, gears and minor parts, $5-$10. The base of the upright standard can be made demountable, so that the projector may also be placed in the standard position for horizontal distance projection. With such an arrangement one and the same projector can be used for group purposes as well as individual cinemanalysis. The frame counter is a very desirable feature, for exact recording of the frames and for quantitative studies.

tance. The student may freeze or activate the behavior to suit his observational interests. He can project the image at a normal rate of 16 frames per second. Time and time again he can witness the
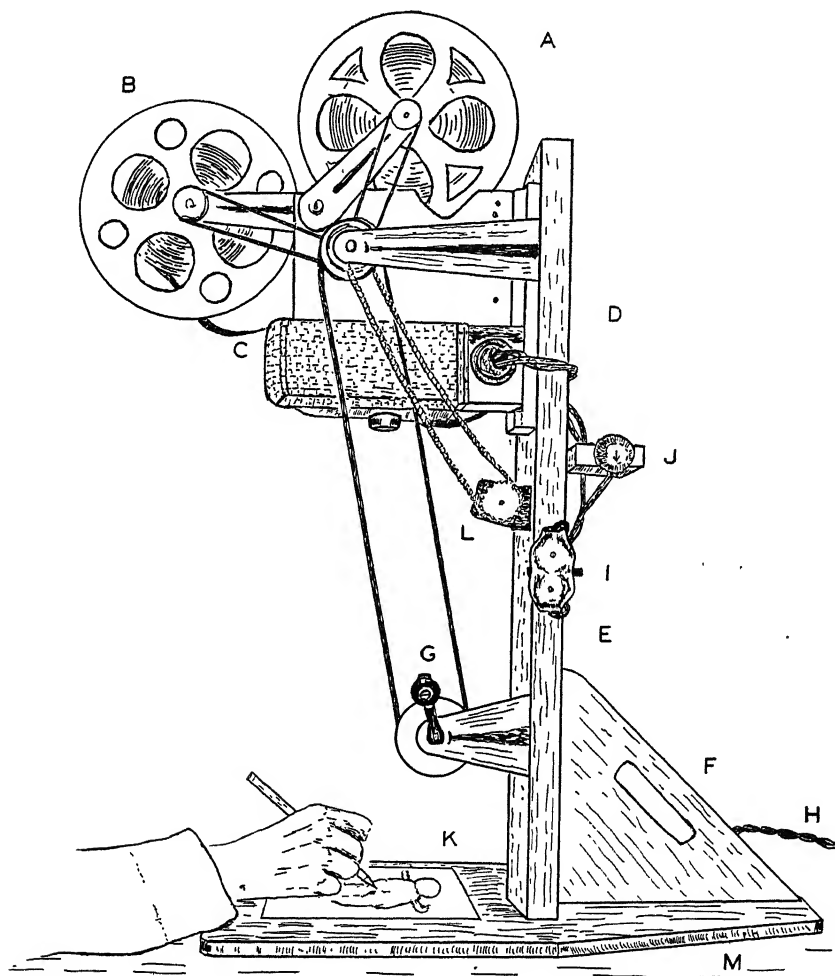
FIG. 22. Analytic viewer, for the study of cinema records of infant behavior.

selfsame behavior episode, selecting first this then that aspect for intensive or repeated observation. By slowing the crank he can project at the rate of about two frames per second, which renders the behavior in slowed but confluent motion. He may project at the

rate of one frame per second and get a succession of intermittent stills. He can, of course, accelerate and speed up the motion. He can always slow down to regain analytic grip on the data under observation. When that grip falters, he simply reverses the crank and inspects the sequence again.

This type of observation is genuine study. It requires active rather than receptive attention. It fosters independent insight. It instills thorough familiarity with the subject matter.

If developmental diagnosis is to be assimilated into clinical medicine, the student must be prepared to examine the records of behavior pattern with the same minute interest in structured form which the disciplines of embryology and anatomy demand. This approach to the behavior symptomatology of child development can be realized only through a laboratory type of individual study, in which the primary teaching burden is placed upon the student himself. In order that the self-instruction may be most purposeful and economical of time, it should be guided by reading which sets up defined objectives.

Toward this end we are organizing a series of films and a syllabus of readings and directions, designed for independent, individual laboratory study. These visual materials can be used to advantage in connection with a didactic course; but they are planned to be self-sufficient when such courses are not available.

In the interests of convenience and flexibility the *Self Instruction Behavior Films* are presented in units which may be used more or less independently; each unit being self-contained within a given topic or subtopic. For comprehensive and systematic training the entire series may be used in a prescribed order. The films are classified into three groups:

I. Normal Behavior Development
II. Clinical Defects and Deviations
III. Methods and Procedures

With a few exceptions the films in Group II which deal with clinical abnormalities, will be limited to use by the medical profession.

A preliminary listing of the subjects to be made available follows. A large number of the films can be used as a supplement to the present volume. They illustrate the key ages and the growth trends, and the norms of development outlined in Chapter III. The clinical

films are illustrative of developmental defects and deviations, particularly those outlined in Part Two, (Chapters vii-xvii). The demonstration films delineate the examination and observational procedures outlined in Appendix A.

Films in the Self-Instruction Series

I. Normal Behavior Development

1. Four Weeks
2. Sixteen Weeks
3. Twenty-eight Weeks
4. Forty Weeks
5. Twelve Months
6. Eighteen Months
7. Two Years
8. Three Years
9. Neonatal Behavior
10. An Ontogenetic Biography of Behavior: A Consecutive Record of Behavior Patterns from Four weeks to Five Years of Age
11. The Patterning of Prone Behavior in the Human Infant
12. The Development of Thumb Opposition in the Human Infant
13. Handedness. The Development of Laterality from Birth to Age Ten
14. Patterning of Leg Behavior in the Supine Infant
15. The Growth of Visual Fixation in Early Infancy

II. Clinical Deviations and Defects

1. The Influence of Thyroid on the Growth of Infant Behavior in Cretinism
2. The Development of Behavior in Fetal-Infancy
3. The Development of Behavior of a Premature Infant
4. Behavior Studies of Cerebral Injury
5. Tonic Neck Reflex—Normal and Pathological Manifestations
6. Mental Deficiency, Hypertelorism, and Dyspituitarism
7. Low Grade Mental Deficiency
8. Near-blindness with Congenital Cataracts
9. Multiple Congenital Deformities
10. Mental Deficiency of High Grade
11. Developmental Neurology

§ 5. ASSOCIATED READINGS

The value of instructional films depends not only upon their content, but on the availability of explanatory and interpretive readings. The following selected bibliography lists publications which bear directly on the subject matter of the films. The titles are annotated with special reference to related cinematic studies of infant behavior and child development.

Gesell, A. et al. *An Atlas of Infant Behavior: A systematic delineation of the forms and early growth of human behavior patterns,* in two volumes, illustrated by 3,200 action photographs. Volume *One: Normative Series,* pp. 1-524; Volume *Two: Naturalistic Series,* pp. 525-922.

> Volume One depicts the pattern phases of typical behavior of normative infants in the standard test situations at 4, 6, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, and 56 weeks of age. Volume Two reproduces naturalistic cinema excerpts of the daily life of normal infants including sleep, waking, feeding, bath, play, bodily activities, and social behavior.

Gesell, A. and Thompson, H., assisted by Amatruda, C. S. *The Psychology of Early Growth including Norms of Infant Behavior and a Method of Genetic Analysis.* New York: Macmillan, 1938, ix+290.

> A key to the delineations of the Atlas, listing in detail the various behavior patterns observed in the normative test situations.

Gesell, A. and Thompson, H., assisted by Amatruda, C. S. *Infant Behavior: Its Genesis and Growth.* New York: McGraw-Hill, 1934, viii+343.

> An account of methods used in the developmental research of the Yale Clinic with genetic summaries of the developmental trends of infant behavior.

Gesell, A. in collaboration with Amatruda, C. S. *The Embryology of Behavior: The Beginnings of the Human Mind.* New York: Harper, 1945, pp. xix+289.

An ontogenetic account of the patterning of fetal and neonatal behavior from the standpoint of development morphology. Based on clinical and cinematic studies of fetal infants. Illustrated by over 300 action photographs.

Gesell, A. Cinemanalysis: A method of behavior study. *J. Genet. Psychol.*, 1935, *47*, 3-16.

Outlines the principles and techniques of cinemanalysis.

—— The tonic neck reflex in the human infant. *J. Pediatrics*, 1938, *13*, 455-464.

Morphogenetic and clinical aspects of the t-n-r, as revealed by cinema and normative studies.

—— Reciprocal interweaving in neuro-motor development. A principle of spiral organization shown in the patterning of infant behavior. *J. Comp. Neurol.*, 1939, *70*, 161-180.

Cites cinema data in support of the principle of spiral organization shown in the patterning of infant behavior, with special reference to unilateral-bilateral and flexor-extensor relationships.

—— Cinematography and the study of child development. *The American Naturalist*, 1946, *80*, 470-475.

—— Guide to the Study of the Yale Films of Child Development. A handbook of commentary and interpretation to accompany the *Silent Series* of films listed on pp. 457-458. This handbook is made available through Encyclopaedia Britannica Films Inc., 20 North Wacker Drive, Chicago 6, Illinois.

Gesell, A., Amatruda, C. S., and Culotta, C. S. Effect of thyroid therapy on the mental and physical growth of cretinous infants. *Amer. J. Dis. Child.*, 1936, *52*, 1117-1138.

Compares development of six infant cretins under thyroid treatment. Includes cinemanalysis of their prehensory, perceptual, and manipulatory reactions.

Gesell, A. and Zimmerman, H. M. Correlations of behavior and neuropathology in a case of cerebral palsy from birth injury. *Amer. J. Psychiat.*, 1937, *94*, 505-535.

Details the action patterns of athetotic boy (Case 5, Chapter XII § 4) as determined by cinemanalysis.

Gesell, A. and Halverson, H. M. The development of thumb opposition in the human infant. *J. Genet. Psychol.*, 1936, *48*, 339-361.

Developmental and experimental study of the types and degrees of thumb opposition.

Gesell, A. and Ames, L. B. The ontogenetic organization of prone behavior in human infancy. *J. Genet. Psychol.*, 1940, 56, 247-263.

Stages of development in the patterning of prone locomotion and the upright posture.

Gesell, A. and Ames, L. B. Ontogenetic correspondences in the supine and prone postures of the human infant. *Yale Journal of Biology and Medicine*, 1943, 15, 4, 565-573.

Gesell, A. and Ames, L. B. The development of handedness. *J. Genet. Psychol.* (in press).

Gesell, A. and Ames, L. B. The infant's reaction to his mirror image. *J. Genet. Psychol.* (in press).

Ames, L. B. The sequential patterning of prone progression in the human infant. *Genet. Psychol. Monog.*, 1937, 19, 409-460.

The delineation of stages and mechanics of prone behavior in the human infant as determined by cinemanalysis.

—— Some relationships between stair climbing and prone progression. *J. Genet. Psychol.*, 1939, 54, 313-325.

A cinema study of stair climbing behavior in the first three years of life.

—— Precursor signs of plantigrade progression. *J. Genet. Psychol.*, 1939, 55, 439-442.

Cinema and direct observations correlating early (six months) foot patterns with type of prone behavior observed at later ages.

—— The constancy of psycho-motor tempo in individual infants. *J. Genet. Psychol.*, 1940, 57, 445-450.

Cinemanalysis of motor behavior reveals constancy in tempo of individual infants from one function to another and from age to age.

—— Supine leg and foot postures in the human infant in the first year of life. *J. Genet. Psychol.*, 1942, 61, 87-107.

—— Early individual differences in visual and motor patterns. A comparative study of two normal infants by the method of cinemanalysis. *J. Genet. Psychol.*, 1944, 65, 219-226.

Castner, B. M. The development of fine prehension in infancy. *Genet. Psychol. Monog.*, 1932, 12, 105-193.

A study of patterns of fine motor co-ordination as revealed by the pellet test.

Halverson, H. M. An experimental study of prehension in infants by means of systematic cinema records. *Genet. Psychol. Monog.*, 1931, 10, 107-286.

—————— A further study of grasping. *J. General Psychol.*, 1932, *7*, 34-64.

—————— Complications of the early grasping reactions. *Psychol. Monog.*, 1936, *47*.

—————— Studies of the grasping responses of early infancy. *J. Genet. Psychol.*, 1937, *51*, 371-449.

Quantitative experimental studies of the mechanisms of approach, grasp, and release.

Ling, Bing-chung. A genetic study of sustained visual fixation and associated behavior in the human infant from birth to six months. *J. Genet. Psychol.*, 1942, *61*, 227-277.

McGinnis, J. Eye-movements and optic nystagmus in early infancy. *Genet. Psychol. Monog.*, 1930, *8*, 321-430.

An experimental study of early eye movements based on cinema records.

READINGS ON DEVELOPMENTAL GUIDANCE

Accurate developmental diagnosis is the most basic essential for all types of child guidance and parent guidance. Mental hygiene measures are pointless and may even be harmful if they do not rest upon sound diagnosis. The primary responsibility of the physician is to make a considered diagnosis and then to interpret the implications of that diagnosis constructively to the parent. The practicing physician has three functions: diagnosis, therapy, and supervision. The most fundamental of these is diagnosis.

The protection of mental health in infancy depends upon individualization of care. Infants are individuals. Clinical pediatrics has established this principle through individualization of feeding. The very fact that the doctor has to modify the dietary to suit individual biochemical needs, shows that the principle must have far reaching importance in the whole field of developmental guidance.

The individual differences of infancy rest on a constitutional basis. Every child has a distinctive style or method of growth. The most penetrating question which one can ask about the individuality of the child is, "How does he advance from stage to stage as he matures?" The essence of his individuality is revealed in his ways of growth. For this reason, an interpretive appraisal of maturity status is the first essential.

Innate growth characteristics determine the course of personality patterning in relation to the patterns of culture. To understand the child we must understand his growth characteristics—how he learns and how he solves his problems of development. This can be best done if from the start we recognize the mechanisms of self-regulation, and the natural fluctuations and changes which come with the progressive stages of maturity.

To see the problems of child guidance in clear focus, we must estimate them in the perspective of development. In perspective, we perceive that growth does not proceed in a straight-line course. It advances by more or less rhythmic fluctuations.

These statements are general but they take on validity, when applied to the concrete problems of infant and child guidance. When an infant is reared with due recognition of his developmental needs, we can observe how the organism regulates its own economy. This principle applies with special force to all the handicapped children. The mental welfare of handicapped children, as well as of normal children, is subject to laws of development which the physician can interpret to the anxious parent.

A developmental approach facilitates the guidance work of the physician and encourages a developmental philosophy on the part of the parents. Such a philosophy has a salutary effect upon parent-child relationships.

The following publications deal concretely with problems of child and parent guidance from a developmental standpoint.

Aldrich, C. A., and M. M. *Babies are Human Beings*. Macmillan, 1938, 128.

  A readable volume, which stresses the individuality of the infant and his growth needs.

Gesell, A. *How a Baby Grows: A Story in Pictures*. New York: Harper, 1945, vii+78.

  A picture story portraying the growth of infant behavior with 800 action photographs. A simple introduction to a development point of view:

Gesell, A. and Ilg, F. L. *Feeding Behavior of Infants: A Pediatric Approach to the Mental Hygiene of Early Life*. Philadelphia: Lippincott, 1937, ix+201.

  An outline of the developmental neurology of feeding behavior patterns. Presents detailed clinical data on the reactions of infants reared on self-demand schedules of feeding and sleep. Deals with the principles and management of self-regulatory procedures. Special sections on weaning, finger sucking, sphincter control, etc.

Gesell, A. et al. *The First Five Years of Life. A Guide to the Study of the Preschool Child*. New York: Harper, 1940, xiii+393.

  A year by year account. Special chapters on the conduct and philosophy

of developmental examination. Discusses clinical adaptations to atypical conditions.

Gesell, A. and Ilg, F. L. *Infant and Child in the Culture of Today: The Guidance of Development.* New York: Harper, 1943, xii+399.

A practical guidance book addressed to parents and child welfare workers. Will assist the physican in planning guidance measures for the periodic supervision of child development.

Gesell, A. and Ilg, F. L. *The Child From Five to Ten.* New York: Harper, 1946, xii+475.

A companion volume to *Infant and Child in the Culture of Today.* Growth gradients and guidance suggestions in ten major fields of behavior: motor characteristics, personal hygiene, emotional expression, fears and dreams, self and sex, interpersonal relations, play and pastimes, school life, ethical sense, philosophic outlook.

McQuarrie, Irivine. *Brennemann's Practice of Pediatrics.*

This standard work includes several chapters which deal directly with developmental aspects of therapy, guidance and health supervision:

> Washburn, Alfred H. *The Appraisal of Healthy Growth and Development from Birth to Adolescence.*
>
> Wetzel, N. C. *Measurement of Physical Growth.* (Analysis of trends with the aid of a growth grid.)
>
> Richards, E. L. *Mental Hygiene.*
>
> Brennemann, Joseph. *Examination of the Child.*

Spock, Benjamin. *The Common Sense Book of Baby and Child Care.* New York: Duell, Sloan, and Pearce, 1945, 527.

This book is written with a direct, simple style. The author applies the principles of growth and development in his instructions to mothers.

For further titles in the literature of developmental guidance, consult the list of *Selected Readings*, pp. 389-90 in Gesell and Ilg, *INFANT AND CHILD IN THE CULTURE OF TODAY.*

PROFESSIONAL TRAINING
FOR DEVELOPMENTAL PEDIATRICS

New trends in pediatric practice place an increasing emphasis on the field of *Growth and Development*. How can this emphasis be implemented through medical schools and teaching hospitals? How can Developmental Pediatrics be brought more squarely into the scheme of pediatric education?

The study of child development can be raised to the status of a clinical subject. That in itself would necessitate basic theoretical instruction concretely related to the clinical manifestations of normal and abnormal growth and development. This objective cannot be realized simply by adding a new subject, entitled Growth and Development, to the curriculum. Both at the undergraduate and graduate levels medical teaching needs to be correlated around fundamental themes.

For the pediatrician the fundamental center of correlation is the child as a unitary organism. To further this correlation, various fields of instruction can be focussed more definitely on the life cycle of the child, using the normal progressions of this cycle as a basic frame of reference. It is the growth cycle which gives unity to the child and which integrates the three panels of his development— the anatomical, physiological, and behavioral. When the study of these panels is pursued too independently, instruction tends to become disjointed. To be sure, the task of correlation falls in some measure on the student, but it is a complicated task and the medical schools should assist him from the beginning to acquire an integrated outlook on the whole field of child development both in its normal and pathological aspects. We need reorientations in medical instruction more than we need change of content. These reorientations can

be accomplished by converging diversified avenues of approach upon central themes.

If development is consistently made a central theme, there are few subjects in the field of pediatrics which cannot in some way be related to factors of age and developmental maturity. A developmental approach might bring an answer to the oft repeated question, Why do we teach embryology at all? The status of embryology in many schools is still somewhat undefined, if not anomalous. Embryology, however, becomes truly a basic medical science in any program of pediatric education which concentrates on the processes of child development. We must, however, adopt Huxley's point of view and give equal weight to the postnatal and prenatal aspects of human embryology. Broadly conceived, embryology includes physiologic functions as well as anatomic structures. Moreover, there is an embryology of behavior and the whole organization of the child's development can be envisaged in terms of a dynamic developmental morphology. We might also remind ourselves of Adami's wise remark that development is a process every whit as real as secretion.

The educational problem is to make this elusive process real to the student by using all possible concrete methods at our disposal. Perhaps we need an integrating textbook which will bring the anatomical, physiological, and behavioral manifestations of growth and development into closer correlation. But even a good book can be vitalized only by contact with concrete, illustrative infants and children. The teaching task is to take the whole subject out of the academic mist and to impart a lively clinical appreciation of the stages and patterns of child development.

In the field of developmental diagnosis, concrete, intimate instruction, both at undergraduate and at postgraduate levels, can be provided through the following procedures: (1) self-instruction films; (2) observation (with discussion) of developmental examinations of normal infants of varying age; (3) observation and case studies of a wide diversity of developmental defects and deviations, examined on an active diagnostic service; (4) graduated participation and practice in the application of the diagnostic tests and norms. Brief comment may be made on these several methods in terms of our own experience.

1. The self-instruction films delineate the characteristic behavior patterns of infants at advancing ages. The student examines these films in precisely the same manner that he studies his histological slides. By means of a personal desk viewer, under his own control, he examines the patterns of behavior, and associates them with a given level of maturity—16 weeks or 40 weeks as the case may be. The basic films chart the normal progressions of behavior. He can study defects and deviations in the same manner. This method makes behavior as organic and as tangible as tissue. Child development is thus made a little less elusive.

2. But visual instruction must be supplemented by demonstration of the living, growing infant. For this purpose we arrange a series of developmental examinations of normal babies at progressive ages. The student witnesses the examinations from behind a one-way-vision screen. Conferences follow immediately; they lead to comparative, systematic discussions, because the diagnostic examinations of behavior were made with a standardized technique which exposes the lawful sequences of development. Through such systematic presentation the study of normal child development can be raised to the status of a clinical subject.

3. The significance of normality is enhanced by similar contact with retarded, atypical, disturbed, damaged, and defective infants. Our diagnostic service provides a plentiful array of these conditions of maldevelopment. They are examined by the selfsame standardized methods employed with normal infants. Many of these infants have been repeatedly examined at earlier ages. This doubles and deepens the developmental perspective. The child, in conference, is not only compared with the normal maturity norms; he is compared with his previous self (often with previous cinema records to document the evidence). So again a comparative, normative approach serves to give reality to development as a process.

4. For the postgraduate physician, who has already served an interneship in pediatrics or neuropsychiatry, we provide a specializing externeship of one or two years in duration. After an induction period of observation and of laboratory study of the self-instruction films, he is initiated into actual examinations of normal infants. As he develops skill and confidence he is given increasing responsibility with the cases admitted on the diagnostic service. He soon

discovers that the behavior tests are not as simple nor as automatic as they may have appeared. He begins to respect them as diagnostic tools, which must be applied with finesse, and which become effective only as he can bring a fund of clinical experience critically to bear.

In this way he arrives at a medical outlook upon the everyday and the unusual problems of child development. The term development has now become less abstract for him. He thinks in terms of norms and patterns of maturity, of growth trends and growth capacities. He envisages the infant and child as a growing organism, whose mechanisms of development are not altogether past understanding, diagnosis, and supervisory guidance.

We know of no other way in which clinical and teaching personnel can be adequately prepared for responsibilities and leadership in the field of Developmental Pediatrics—a field which may well become a subspecialty and recognized as such by a board of certification. Both in private practice and in public health organization there is bound to be an increasing emphasis upon a supervisory type of clinical pediatrics which will include normal as well as sick, defective, and handicapped children. To meet these mounting social demands, there will naturally be reorientations—and perhaps even a mutation or two in the evolution of pediatric education.

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